SCIENTIFIC AMERICAN

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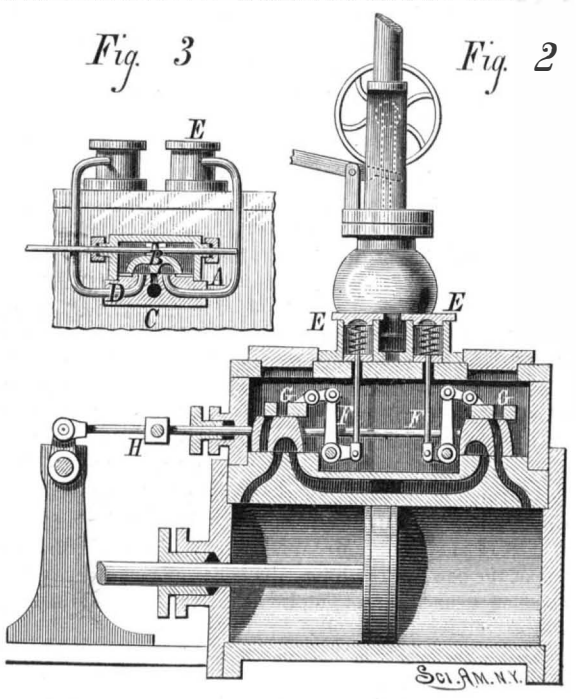
IMPROVED VARIABLE AUTOMATIC CUT-OFF.

In the device herewith illustrated the inventor has aimed to provide a variable automatic cut-off gear which may be applied to plain slide valve engines, and render the working of the same fully as economical as if they had been specially constructed in connection with an improved apparatus of the kind.

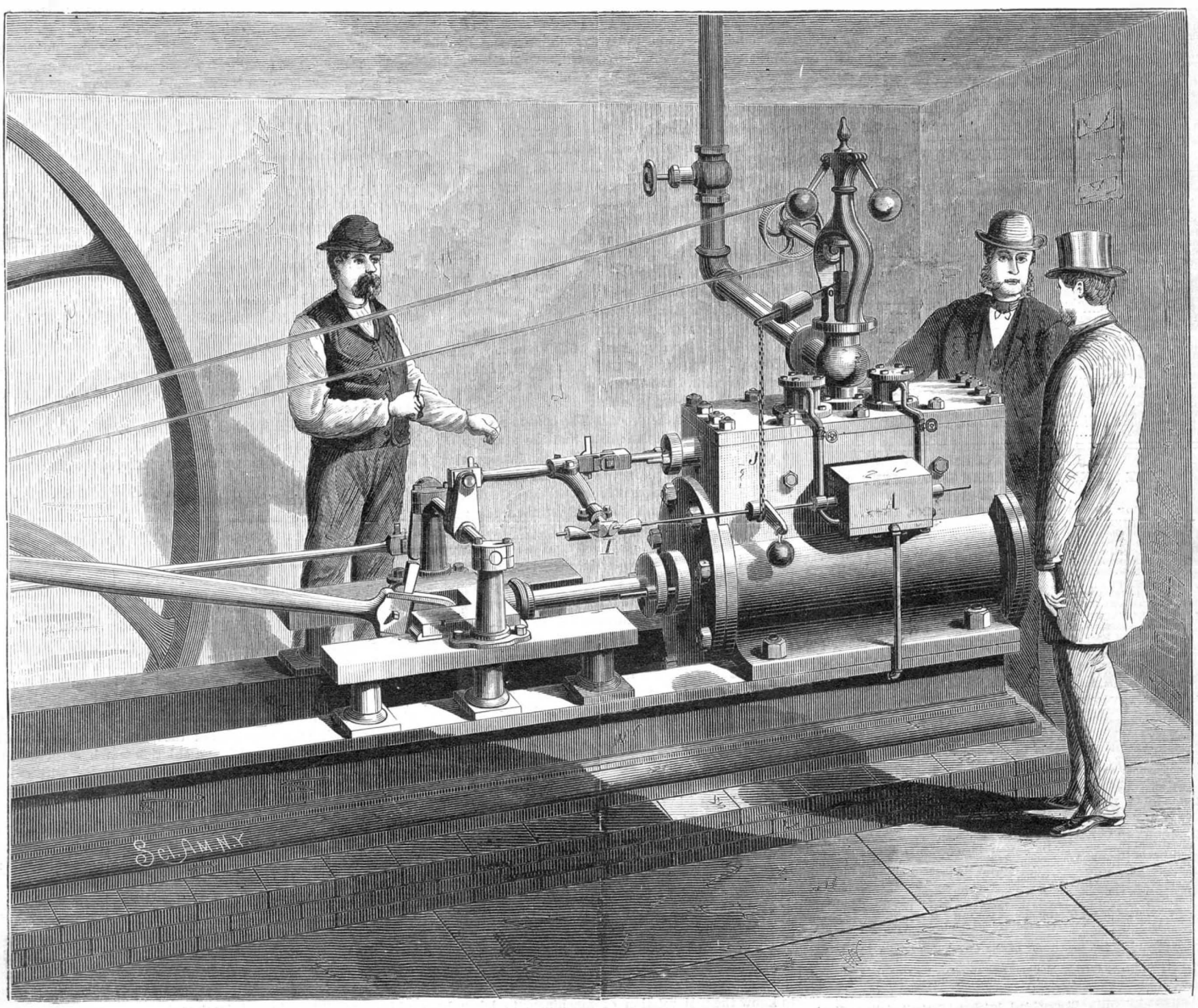
A general view of the apparatus in position is given in Fig. 1, and the details will be understood from Figs. 2 and 3. It is so constructed that should the motion of the engine become too rapid, it will cut off the steam automatically at each stroke of the piston until the engine has been slowed down to the proper speed. Beside the valve chest is a secondary chest, A, Fig. 3, in which is the valve, B. This chest has an exhaust port, C, and ports, D, leading to the cylinders, E, attached to the top of the main valve chest. The chest, A, is connected to the main chest by a passage, so that the pressure may always be the same in both chests. In the cylinders, E, are spiral springs which rest upon steam-tight pistons, to which are attached rods which pass down into the main valve chest and are attached to elbow levers, F. The holes in the chest through which the rods pass are made larger than the rods, so that the steam may have free passage. The elbow levers communicate, as shown, with plates, G, placed on top of the slide valves. These plates have ports through which the steam passes in its traverse



through the ports of the slide valve to the main cylinder ports. When the engine is running at ordinary speed the plates, G, are in such a position that their ports may be directly over the main ports. To the valve stem, H, is attached an arm which carries a wedge-shaped head, I (see Fig. 1), and through this passes the valve steam from the secondary chest. On the last mentioned stem are adjustable collars, and also connected to the stem is a chain, J, which carries a weight, and which, after making one or two turns around the stem, communicates with a lever which is connected with the governor.

With this construction, as the speed of the engine increases, the outward movement of the governor balls causes the lever to be depressed and the valve stem to be turned, so that the head on the arm will strike the collars on the stem and thus move the valve, B, on its seat. As this valve moves it connects one of the ports, D, with the exhaust, C, so that steam may escape from the upper part of the cylinder, E, with which said port is connected. This allows the steam pressure of the main valve chest to raise the piston in said cylinder, E, and hence to move the plate, G, with a positive motion to shut off steam. This happens at each stroke of the main piston until the speed of the engine has been reduced to its ordinary amount.

We give indicator diagrams from an engine, fitted with this cut-off in Fig. 4. The valve gear has been, we are in-



DINGLEY'S VARIABLE AUTOMATIC CUT-OFF.

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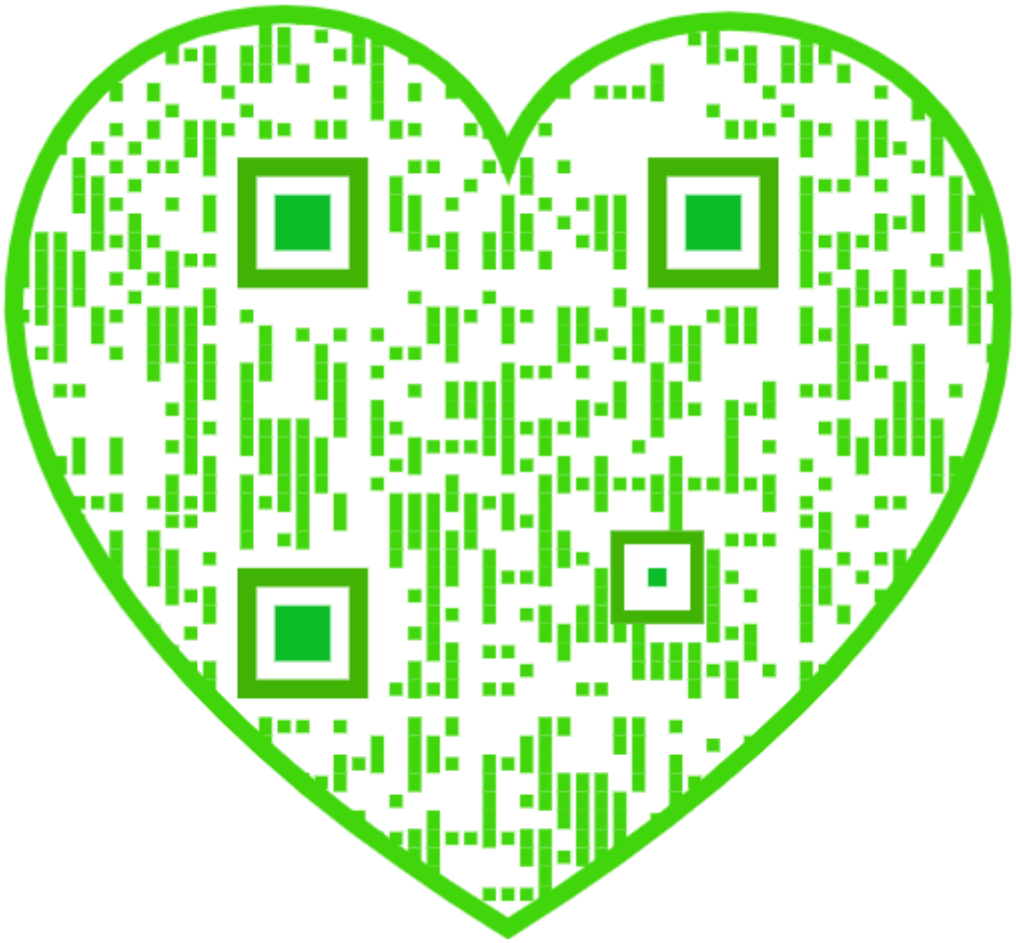

formed, in successful operation for the past six months no H. L. Weston's engine, corner 29th street and Seventh avenue, New York city, where it may be seen in operation.

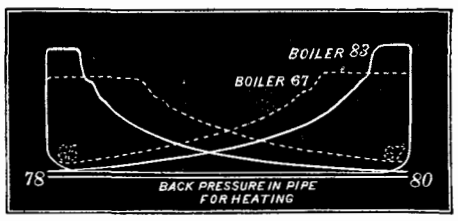

Fig. 4. IMPROVED VARIABLE CUT OFF.

For further particulars relative to sale of patent, etc. (dated April 30, 1878), address the inventor, Mr. E. L. Dingley, 112 Wooster street, New York city.

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THE USES OF MECHANISM.

The press reports inform us that at the beginning of the harvest season the farmers of Ohio were warned, through a circular letter signed "Working Men's Bread or Blood Committee," that if they used mowing or reaping machines in getting in their crops, the machines would be destroyed and the barns containing the gathered crops would be burnt.

The machines were used as a matter of course; and happily the threatened destruction of machines and crops has not been attempted. Whether we are to attribute the escape of the farmers to their extra vigilance or to the absence of any considerable following to the ill-named committee, it is impossible now to say. It would be pleasant to know that the latter reason was the true one, and that even among the lowest of the farm hands of the West there is no large number of men who keep up the ancient and witless feud against machinery. But what can we expect of the untaught, when men in the higher ranks of society, to whom the truth is easily accessible, persist in teaching the industrial foolishness that machinery lessens the demand for men?

Witness the venerable Thurlow Weed, whose advanced age and long association with political affairs ought to have given him, one would think, the means for forming a just judgment on this point. Yet this is the way he moralizes when he gets to talking of the changes he has witnessed:

"I am amazed when I look back and think of the changes that invention has wrought in the life of society," he said the other day to a *Tribune* reporter. "The gas jet has taken the place of the tallow candle, the telegraph of the post; but the changes are mainly due to steam and the multiplication of machinery. This affects—indeed, has revolutionized—all the industries of the country. Even the agriculturist has superseded hand labor almost wholly with machinery. This has thrown hundreds of thousands of people out of their ordinary employment." Further on, while deploring the influence of machinery, Mr. Weed remarked: "Take the example of the sewing machine. This has thrown tens of thousands of women out of employment, and affected the morals of the country alarmingly."

That position is not less powerless than age to ward off the foolishness of willing ignorance is evident from the following utterance of Senator Beck, which we find in the *Congressional Record* of May 2. He said:

"Machinery is driving out of the manufacture of products hundreds and thousands of human beings every year. We have machinery to-day in this country that can do the work of one hundred and seventy-five million men. I think it can do the work of two hundred millions; but the report says one hundred and seventy-five millions. Each machine that is invented and put in operation drives from the manufacture of the articles that it manufactures all the human labor that formerly did its work. I repeat that hundreds and thousands of human beings were at one time earning an honest living by doing the work that machinery now performs."

At a time like this, when so many designing demagogues are trying to make political capital by playing upon the ignorance and prejudice of the least informed of the working classes, talk like this from men in the position of Senator Beck and Thurlow Weed is unpardonable; it is worse than foolish; it is positively criminal. Not only is there no evidence to give it a shadow of justification, but the proofs of the contrary are abundant and accessible to all. The readers of the SCIENTIFIC AMERICAN have had almost a surfeit of such evidence in recent issues of this paper.

Mr. Weed tells us that tens of thousands of sewing women have been turned out of employment by the sewing machine, and multitudes have been driven in consequence to a life of crime. Where is the proof? The census reports show two things in this connection: first, that the earnings of sewing women have largely increased since the introduction of sewing machines; and second, that the number of persons earning a living by sewing has increased since that invention was made, in a ratio considerably larger than the ratio of increase for the entire population. The truth is, that so far from lessening the employment and wages of women, the sewing machine has largely increased both. If Mr. Weed has any private evidence to the contrary, we should be glad to see it. And so with the "hundreds of thousands of farm hands" that have been thrown out of farm work by farm machinery. Where are they? The best evidence we can find—the census reports—show that since the introduction of agricultural machinery there has been not only a large and rapid increase in the number of farm hands employed in this country, but the rate of such increase has been much greater than the rate for the population as a whole. More than that, as shown in a late issue of this paper, the increase of farm hands has been vastly greater and more rapid than would have been possible without the aid of machinery. As Elihu felt constrained to remark in that most ancient of symposiums, recorded in the Book of Job, "Great men are not always wise, nor does wisdom always come with age."

Witness again the honorable Senator from Kentucky. "We have machinery," he says, "that can do the work of two hundred million men, and every machine has turned out of employment as many men as it can do the work of." Such being the case, we cannot escape the conclusion that our machinery has usurped the employment of more men than were ever engaged in manual production in all the world!" Had Mr. Beck been possessed of the slightest desire to know the real relation of machinery to labor, he could easily have learned that in every instance the introduction of machinery has been attended by an increase in the number of men employed in the trade or trades affected. Abundant evidence of this great law of industrial economy has been given in recent issues of this paper. Here are some figures even more significant than any before given, since they cover a period of great industrial depression.

The little State of Rhode Island is nothing if not mechanical. There never was a time when machinery was more rapidly introduced and improved than during the years between 1870 and 1875. Comparing the manufacturing statistics of the State given in the National census report of the former year, and those of the State census of the latter year, it appears that notwithstanding the panic and its results there was, during these years, a considerable increase in the number of hands employed and in the wages paid:

All Manufactures.	1870.	1875.
Number of establishments	1,850	2,019
Capital invested	$66,557,322	$49,942,871
Hands employed	49,417	56,540
Wages paid (per annum)	$19,354,256	$23,707,513
Value of raw materials used	$73,154,109	$76,715,970
Value of products	$111,418,354	$126,659,875
Number of steam engines	402	523
Horse power of engines	23,546	34,241

A like comparison of State and National statistics with regard to the cotton factories of Massachusetts shows similar results, except in the latter case there was an increase in the amount of capital employed, and a larger increase in the number of hands at work:

Cotton Manufactures.	1870.	1875.
Number of establishments	191	220
Number of spindles	2,619,541	3,859,237
Persons employed	43,512	60,176
Capital invested	$44,714,375	$63,844,708
Value of stock used	$37,371,599	$41,059,893
Value of goods made	$59,403,153	$77,934,753

Thus we see that notwithstanding the increase in the number of steam engines and other productive machinery in Rhode Island—more properly, in consequence of such increase—there was a gain of 14 per cent in the number of operatives employed, while the gain in the cotton industries of Massachusetts was 26 per cent during the same five years. In Ohio, as in several other Western States, the progress of manufacturers and the increase in the number of hands employed were very much greater. The census of 1870 gives the value of the manufactured products of Ohio as $269,713,000. The report of the State Auditor for 1875 makes the value of the same line of products $400,000,000.

It is true that during late years financial disasters, not in any way due to machinery, have stopped many factories and thrown many operatives out of employment; but the number of such men out of work is as nothing compared with the swarms of laborers thrown out by the stopping of city "improvements," and other jobs of like nature. And those industries into which machinery has been most largely and successfully introduced are just the ones which suffer least to-day, and have suffered least since the hard times began.

It is time the cant about machinery hurting men was banished from respectable society; time that men who have learned that the world is not flat shall learn also the equally well demonstrated truth that it is not possible for machinery to give employment to steadily increasing numbers, and at the same time turn out of employment every year twice as many men as were ever at work. It is bad enough for Kearneyites and Socialists to indulge in such nonsense. From Senators and "venerable statesmen" it is intolerable.

WORKING GOLD ORES.

Communications are sometimes addressed to us asking our advice or opinions concerning various methods of working gold ores, and recently several correspondents have sought to know if there be any approved way of saving the fine gold which is coated or incased with iron or other substance that prevents or seriously interferes with amalgamation.

The chlorination process, which dispenses with amalgamation, has long been in practice in this country and gives very satisfactory results, being especially adapted to the treatment of ores containing fine gold. The ore is stamped, then roasted and stirred in a furnace at low temperature until all the sulphurets, etc., are decomposed, then removed, spread and cooled, after which it is moistened with water and introduced into wooden tubs or vats, with bottoms arranged for the admission of chlorine gas, which is generated by heating a mixture of sulphuric acid, manganese, and salt. This gas is conducted into the tubs until it has covered and penetrated the mass of ore, and is allowed to remain in this intimate contact for several hours (the time depending upon the size of the particles of gold), until all the gold is converted into a chloride which is soluble in and is then dissolved out by water, to be treated with sulphate of iron, which precipitates the precious metal in a metallic condition as a fine dark brown powder.

This is unquestionably a sure process, but its economical value depends very much upon the proportions or amounts of the base metals in the ore. To overcome what may almost be termed the repellent action of this coated fine gold upon mercury—to prepare it for amalgamation—nitric and sulphuric acids have been used and rejected because of the expense; for they will not select and remove this coating to the exclusion of the inferior metals, for all the copper, iron, etc., present equally demand their share of the reagents; so that it is only ores of exceptional character and richness that will justify such treatment.

As it is especially those particles of gold, so minute and thin that they escape the action of the stamps, which, in many instances, form the larger percentage of the assay, and

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which nevertheless elude amalgamation, it is evident that stamps are not suited to this class of ores unless another manipulation is introduced between them and the amalgamator, and to our mind a most efficient one would be to heat the fine ore to a bright red or white heat and suddenly cool it with water, the theory being that the expansion by heat and instant contraction by cold will scale off or crack the coating so that the mercury can get at the gold by the usual processes of amalgamation.

We remember somewhere to have read of a furnace especially designed for this purpose, but do not at present recall its history, but the feasibility of the plan seems to us undoubted. Another method which has been suggested and which has a practical look about it is to reduce the ore to a fine powder in some machine which will cause so violent an attrition of the particles one against another as to rub off the interfering casing or coating and leave them clean and bright for the action of the quicksilver.

It is claimed that this is effectually done by one or more of the pulverizers or attrition mills now in the market, and that they also separate the metal from the gangue or matrix much more thoroughly than can be or at any rate is done by stamps, and that they deliver it in a condition more favorable for the action of the amalgamator, in pellets instead of in thin, flattened particles which so largely escape with the overflow of the water; but of these points mining superintendents can best judge of actual trial; and the importance of finding a solution of them should warrant the expense of thorough investigation.

Neither tradition nor modern practice has helped us to such understanding of the working of the refractory gold ores as they have of the ores of silver, and, in consequence, to this day we are neglecting many of our richest gold mines for the comparatively poor but more easily worked ones of the other metal.

A successful process is not necessarily—indeed must not be—a complicated or expensive one, and these which we have suggested seem, in these respects at least, to answer the requirements for a certain class of ores; but there are other ores of gold—notably the tellurides, which are among the richest—demanding improved methods of working, and sure to amply reward the successful inventor.

The action of these ores under the blow pipe frame would seem to indicate that two of the conditions necessary to successful reduction must be an exceptionally high temperature in combination with an abundant supply of air.

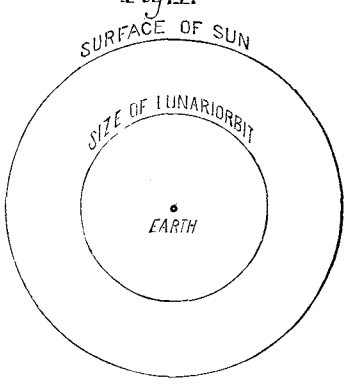
THE SUN.

BY S. P. LANGLEY, ALLEGHENY OBSERVATORY, PA.

In giving a brief account of our knowledge of the sun, which I have been asked to prepare for the readers of the SCIENTIFIC AMERICAN, it may be presupposed that all know how within a few years we have come to a new sense of the sun's immediate importance in every action of life. Men have always known that it lighted them, and ripened their grain for the harvest, but lately we have discovered that our own bodies are grown by it as much as the corn in the fields, and that in fact everything that has life on earth is made by it.

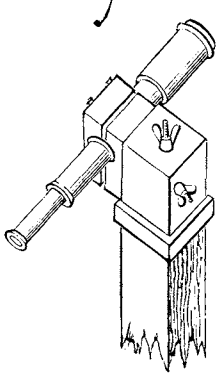
George Stephenson, according to a well known anecdote, used to believe that the sun, in some way, drove his engines, though he could not exactly explain how; but now we know, exactly speaking, that not only every movement

Fig. 1.



SPHERE OF SUN & LUNAR ORBIT

Fig. 2.



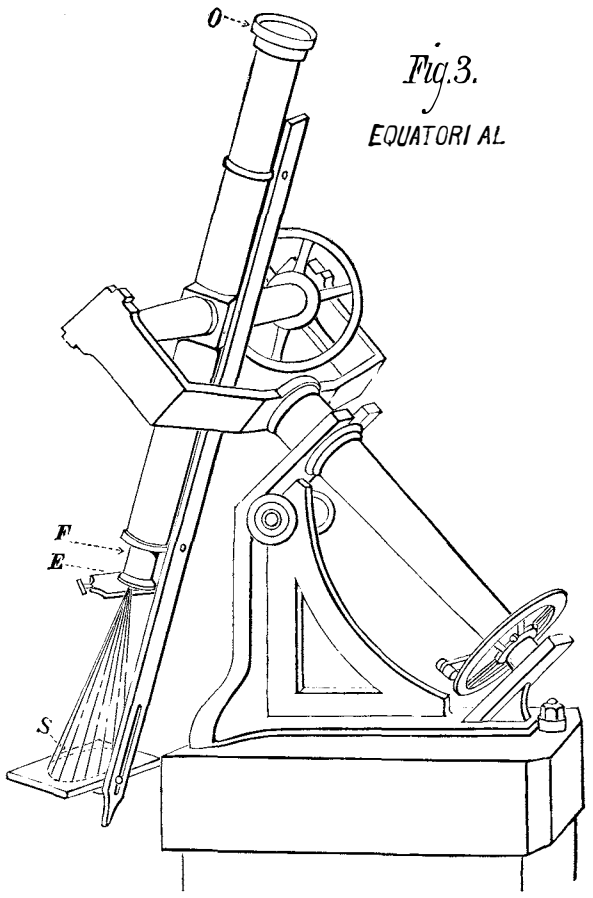
of every living thing comes from a motion that once started from the sun, but that, whether it is an ant lifting a grain of sand, or an engine raising a forty ton hammer, it is there the power comes from, as clearly as that which moves the piston comes from the boiler. These being not figures of speech, but statements meant to be taken literally and in their plain meaning, it is easy to see why the study of solar physics is growing in importance, as it is being found to have a bearing on almost every branch of human knowledge, and in unlooked for places. Thus the geologist shows not only that the sun put the coal in the ground for us, but that it piled the ice in the glaciers, which were once dragged along the northern continent; the chemist finds its rays affecting the most intimate properties of matter, and so on through the range of natural science, while the writers of the new history are bringing to notice the way in which it has affected the mental differences between the races of the North and South, and has in the course of ages imprinted its effect on the human mind itself.

We shall now try to give, in the plainest way, the principal facts known about this great source of power; some intelligible idea of the means by which they have been discovered; of the apparatus of research, and of the direction original research is now taking. To do this we must begin with the knowledge of a few things about its distance and size, which given in round numbers can be easily remembered.

The sun's distance, then, is 92,000,000 miles; its diameter 860,000 miles; its surface between 11,000 and 12,000 times and its volume about 1,300,000 times that of our globe. It is easier to read such figures than to grasp the reality they convey, but this latter is all the more necessary because we have a disposition to look on the heavenly bodies as less real and material than things at hand. The sun, though, is just as material a thing as a hot coal in the grate, and we can tell, for instance, exactly how many million tons of coal would keep up its heat supply during one

Fig. 3.

EQUATORIAL



minute. Let us try to make these great numbers more comprehensible by comparison. In rapid railway travel, continued day and night at the rate of 600 miles in twenty-four hours, we should be forty days in making the circuit of the earth. The same uninterrupted speed would take us to the sun in rather over 400 years. An ordinary telegraphic signal, if a continuous wire were laid round the earth, would circuit the globe in very nearly one second. If the wire stretched from the sun to the earth, the armature would not move in the terrestrial station till over an hour after the solar operator had pressed the key, or, as it has been ingeniously said, in reference to the fact that sensation requires a certain known though very brief time to travel up the nerves from the hand to the brain, "if a man's arm were long enough to let him touch the sun, it would be over three years before he felt that his fingers were burnt."

The actual size of the sun must evidently be immense to appear as large as it does at such a distance, but this known diameter of 860,000 miles, applied to a sphere of continuous matter, is again nearly inconceivable. To get some notion of it, suppose the sun were hollowed out, and that the earth were placed in the center of the empty shell. Now if the large circle in the figure, Fig. 1, represent the globe of the sun, the dot at its center represents with approximate correctness the size of our earth, and the small circle the actual orbit of the moon, which might revolve at the same distance from the earth as now within the globe of the sun, and still have nearly 200,000 miles clearance between it and the surface! As for figures representing its bulk we must simply forego any attempt to "realize them," and we shall find a similar difficulty when we come to measure its heat.

We must leave the description of the methods by which astronomers have determined these dimensions, untouched, and pass to an account of the solar surface and the means by which we study it, some of which are simple enough to be within the reach of any reader who wishes to see for himself.

The most primitive apparatus by which we can ordinarily see the sun's spots consists of a darkened room with a pinhole in the shutter, letting a single beam of light in. The little circle of light seen on a paper held in the course of the rays, and which enlarges as we go away from the pinhole, is an image of the sun itself, and if the room be long enough to admit of a circle of two inches or more being formed, any considerable spots may be seen without the use of any lenses whatever. I have seen even a small spot in this way, but would hardly advise any one to take much pains with the experiment, for the results are not worth it; though by this rude means the first transit of Mercury ever seen was observed by an early astronomer, Gassendi. A very much better view can be obtained by any one who has a good spyglass, and will take the trouble to secure the necessary steadiness by mounting it on a post, with the help of two small blocks of wood and two thumb-screws, so as to turn in any direction and be clamped there. If the two screws about which the blocks pivot, Fig. 2, are one horizontal, the other vertical, the telescope moves "in altitude," or up and down, with the block turning about the horizontal screw, and "in azimuth," or parallel to the horizon, when the second block turns about the vertical screw, carrying the first with it. A combination of the two motions enables it to be pointed anywhere, and such an instrument, whether made at the cost of a few cents by the roughest carpentry, or in brass and steel by the optician at the cost of thousands of dollars, is the same in principle, and is what astronomers call an "alt-azimuth."

When we first look at the sun through a telescope so mounted and clamped, we are surprised to see how fast it moves out of view, and how busy we are kept in following it. In the morning we not only have to be moving the telescope around the vertical axle to follow the sun's westward motion, but upward about the other, to keep pace with its rising one; and in the afternoon, while still changing to the westward, we have at each such change to point lower also. To avoid this double motion let the top of the post be sawed with a slope to the north, so that if one side of a carpenter's square be laid on the incline, the other will point to the north pole. If the screw which before was vertical be set into the sloping face, and the arrangement be otherwise unaltered, the telescope will now follow the sun with a single motion, which is parallel to the equator, since the pivot on which it turns now points to the pole, the instrument thus turning about part of the same axis the heavens themselves appear to revolve on.

An instrument so mounted, whether roughly or elaborately, is called an "equatorial," and this is the form almost universally employed by astronomers in physical research. The annexed engraving, Fig. 3, shows the principal parts of a small equatorial which is being used to view the image of the sun by projection.

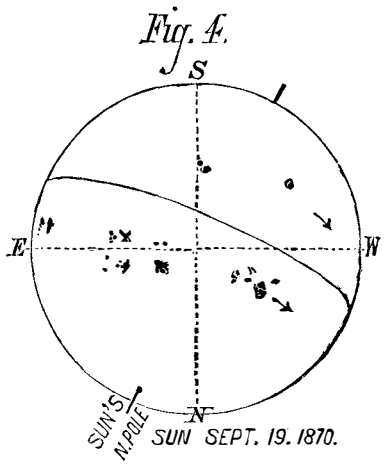
The rays condensed by the object glass at O form a small picture of the sun at the focus, F, and the enlarging lenses of the eyepiece at E cause them to diverge again, making on the screen at S a picture of the sun with everything on its surface. This simple means is still employed with advantage even on the large instruments of observatories, and it gives a much better view than the direct one with common darkening glasses. The screen can be attached to any telescope or spyglass in the way shown in the sketch. If a very low magnifying power be used the whole sun can be seen at once, and the appearance of the spots, the progress of a solar eclipse, or the transit of a planet watched with ease by a number of persons.

If the screen be replaced by a collodion surface at the focus, the little picture may be permanently fixed by photography, and in this way very admirable records have been obtained by Mr. Rutherfurd of New York, Mr. De la Rue in England, and quite recently by M. Jannsen in France. Of these we shall speak later.

STUDY OF THE SUN'S SURFACE.

Let us place our screen at a proper distance, say from one to two feet from the eyepiece, and turn the telescope on the

Fig. 4.



SUN SEPT. 19. 1870.

sun, observing that it will usually be best to diminish the aperture of the object glass (by a paper diaphragm) to at least one twentieth of its focal length, and thus lessen the danger of breaking the other lenses by the heat.

When we point near the sun but not on it, a circle of light will appear on the paper which must not be mistaken for the solar image. This latter, unless a very low power be used, will appear as a larger circle invading the first one, and it will be blurred and indistinct until the eyepiece and then the screen have been adjusted to a correct focus. This is done by moving the eyepiece in or out until the "limb" (that is, the edge) of the sun appears sharply defined. Here is a miniature copy of a tracing of the sun's face, thus made directly on the paper at the Allegheny Observatory on September 19, 1870. (Fig. 4.)

In the intense whiteness of the solar image we see a number of small spots, and these are not on the paper, for they will not move with it, nor in the glasses, for they do not change when those are turned round. They must be, then, in the sun itself. Some of them are hardly more than specks, but we will select one of the largest (that at A) for further examination, and see afterward what it looks like when more magnified. First, however, trace the outline of the image with a pencil and in the same way pencil over the spots, and we have just such a little permanent picture as this. The astronomical telescope reverses everything, but

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the true cardinal points are easily found. Thus we notice the direction in which the sun moves off the paper, and find it will always be the western side which moves off first. One of the most important, perhaps the most important, of modern discoveries was made by no more elaborate apparatus than this just described.

Schwabe, a German observer, not a professional astronomer, began in 1825 to make daily a little sun drawing the size of our sketch. When he began the spots could be seen almost any day in numbers, but they grew fewer, as he noticed, year by year, till in 1833 they had almost ceased to appear at all. Though scarcely anything was now to be seen, he continued his daily observation till 1836, when they were again plenty. This looked as though there was a cycle during which their number and size waxed and waned; an important fact if true. To determine its reality, Schwabe, with German patience, kept up his daily drawing for forty-two years! His labors were rewarded by the discovery of the law which brought the latter part of his life abundant honor. Their result may be seen from the following table, prepared by Messrs. De la Rue, Stewart, and Loewy, after measuring with persevering labor the great number of drawings Schwabe put into their hands:

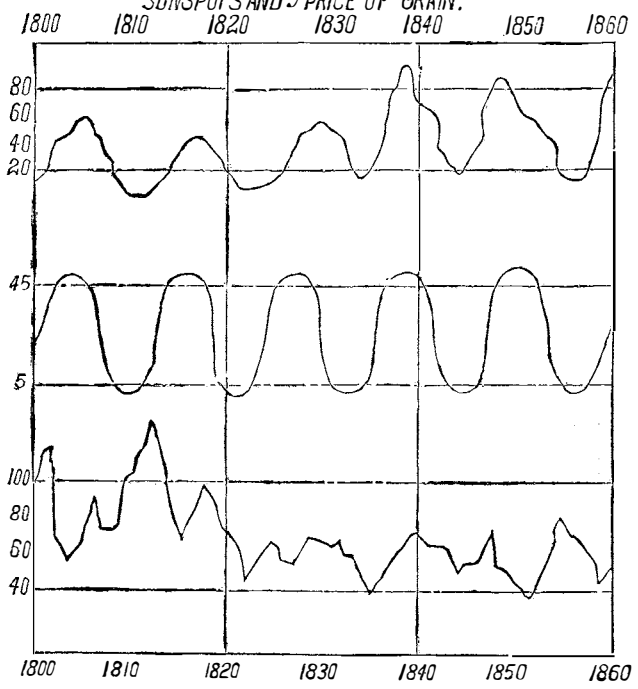
First	minimum of spots about		November, 1833.
"	maximum	" "	December, 1836,
Second	minimum	" "	September, 1843.
"	maximum	" "	November, 1847.
Third	minimum	" "	April, 1856.
"	maximum	" "	September, 1859.
Fourth	minimum	" "	February, 1867.

Thus, the sun was remarkably free from spots in 1833; they increased in number and area till 1836, after which they diminished till 1843, and so on. We can see readily that the increase and decrease are not uniform. Thus from the 1st to 2d minimum is 9·8 years; from the 2d to 3d, 12·6 years; from the 3d to 4th, 10·8 years. Adding, and then dividing by three, we find the average period from one minimum to another to be about 11·1 years, and we notice also that in every case the time from one minimum to the next maximum is less than from that on to the next minimum again, or the spot quantity decreases through a little over seven years, and increases through less than four. We do not in the least know why this is so, and though many attempts have been made to show that certain planets affect spots by their attraction, in the opinion of those who have considered the matter most judicially there is no proof that they are due to any influence external to the sun itself. Now the interest of the question to us lies in the fact that we can hardly doubt that an increase or diminution of the sun's brilliant surface is in some was of consequence to our lives on the earth, when, as we know, these hang from day to day on the maintenance of its heat within certain limits, and it is something at any rate to be able to prophesy from past experience, as we now can, what the condition of the sun's surface will be many years in the future. Thus it will be seen that the next minimum (found by adding 11 years to 1867, when the last occurred) falls in the present year, and the sun's face is at present free from spots, almost beyond any past remembrance. Day after day it is examined here now, to find only a blank, but, as we have seen, there are grounds for confidence that this is not to be the case much longer.

Assertions that laws have been discovered affecting the sun's influence on the weather, in such a way that we can predict whether a coming year will be good or bad for the harvest, are so constantly being made that it seems worth while to let the reader judge for himself of the kind of evidence on which they rest. The best known way to detect the influence of spots, if they have any, on the harvests, or their possible agreement with planetary motions, is to draw curves representing the known fluctuations of each in the past, one above another, when if there be any hidden connection it will be made apparent by the ups and downs of the different curves agreeing. The curves showing the fluctuation of the gold, grain, and stock markets are an example of the same method, which is borrowed from that long used by physical investigators.

Thus, in the annexed figure (Fig. 5) let an inch measured parallel to the bottom of the page represent in every case 20 years of time, and let the figures on the line parallel to the side of the page represent, in the first case, the relative frequency of sun spots (traced back to the beginning of the century through some old observations discovered by Wolf), so that the more spots there are in any year the higher the curve will rise. In the second curve, changes along the vertical line are proportional to the increase or diminution of Jupiter's distance from the sun. In the third and lowest the figures at the side are proportional to the price of wheat in the English market—rising when wheat ruled high, falling when it was cheap. In all three curves $\frac{1}{20}$ of an inch along the top or bottom corresponds to one year; and in this way we have at a glance the condensed result of observations and statistics for 60 years, which otherwise stated would fill volumes. The result is instructive in more ways than one. The variations of Jupiter's distance certainly do present a striking coincidence with the changes in spot frequency, and this may indicate a real connection between the phenomena; but before we decide that they certainly do so we must remember that the number of cycles of change presented by the possible combination of planetary periods is all but infinite. Thus, we might safely undertake with study enough to find a curve, depending solely on certain planetary configurations, which yet would represent with quite striking agreement for a time the rise and fall in any given railroad stock, the relative numbers of Democratic and Republican congressmen from year to year, or anything else with which the heavenly bodies have in reality as little to do. The third curve (meant by the price of wheat to test the possible influence of sun spots on years of good or bad harvests) is not open to the least objection, but involves a fallacy of another kind. In fact, the price of wheat depends on many things quite apart from the operations of Nature—on wars and legislation, for instance—and here the great rise in the first years of the century is as clearly connected with the great Continental wars of the first Napoleon, which shut up foreign ports, as the sudden fall about 1815 (the year of Waterloo) is with the subsequent peace.

Fig. 5.
SUNSPOTS AND PRICE OF GRAIN.

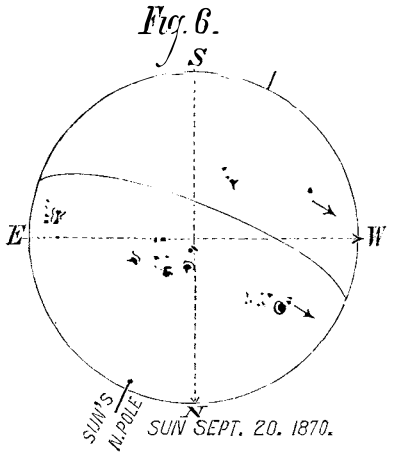


It is not meant that all such attempts are always to prove futile, but our example shows how plausible they may seem, without being necessarily worthy any confidence, and on the whole it is at least doubtful whether the great labor and pains constantly being bestowed on such comparisons are producing, so far, any adequate result.

But let us come back to our telescope and look again at the spots themselves. Here is another view of the sun, taken one day later than the first (Fig. 6), and on comparing it with Fig. 4 we see that all the spots have moved a little toward the west, the one which was just appearing round the eastern edge having come further on to the disk. There are changes among the separate groups also, new spots having broken out in the 24 hours. As all move together, in a general sense the sun must itself be revolving, and thus carrying them along, and, in fact, if we watched we should see the spots go entirely across the sun's face in about 13 days, and disappear round the western side, many of them (not all) reappearing at the east again in about 13 days more. Shall we say that the sun revolves upon its axis like the earth, but in 26 of our days? Not exactly like the earth, for if we observe closer we shall find one feature in its motion which is so extraordinary as to seem at first sight impossible. First let us, by following the directions of the spots from day to day, trace, as we easily can, a line which must nearly coincide with the sun's equator, and notice, as we shall, that all spots lie either some way to the north or south of it (none of them on it) and move in belts on the solar surface, roughly corresponding to our temperate zones. Now if we time them from month to month, we shall notice that those near the equator rotate in less time than those nearer the poles, it being meant, not merely that the sun's equatorial regions move faster in miles per hour, but that their angular velocity is greater. This anomaly will be seen better by reflecting that if such a thing could be, here, the average day might have but 23 hours in Washington and 25 in New York. It is much as though the rim of a great flywheel were observed to make more revolutions per minute than one of the spokes; the outer end of any spoke more revolutions per minute than a part nearer the axle, and so on! We should doubt the evinence of our own senses if we saw the flywheel of an engine appear to do this, without being wrenched in pieces. Yet the sun does it, incontestably. This all but incomprehensible fact (as we may surely call it) was not established till of comparatively late years, Dr. Peters, of Hamilton College, having been the first, or among the first, to announce it over thirty years ago, since which time Mr. Carrington, of England, and others have established it by overwhelming evidence.

If we look attentively we shall also notice that the sun is not equally bright all over, there being a faint shade toward the edge (not shown in the cut), so that the central parts are slightly more brilliant than those nearer the circumference.

Fig. 6.



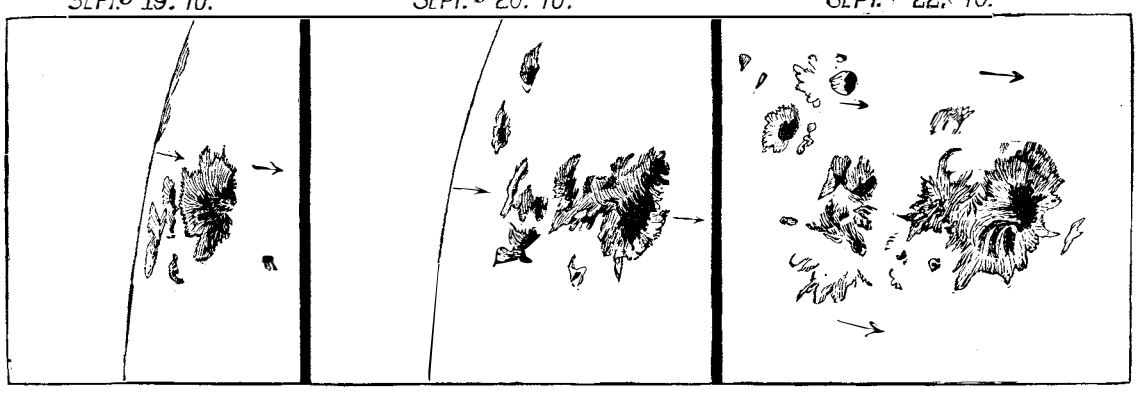
This little circumstance is an indication of no slight importance, since it shows that the sun is surrounded by an atmosphere, for if there were none there would be no such shading from the sun's mere rotundity. This follows from the well known laws of emission, to be found in any physical text book; but to make a practical test we may heat a cannon ball white hot, and then, however we view it, we shall see it presents the appearance of a perfectly flat, uniformly brilliant disk. Mr. Ericsson has been at the pains to perform the experiment, though we have independent evidence that the result described must follow. But if the sun be surrounded by an imperfectly transparent atmosphere, this will cut off part of its heat and light everywhere, but most toward the edge, for we, as it is easy to see, must be looking through greater depths of it, where the line of sight makes a considerable angle with the surface, than at the center, where it is vertical to it. This at first sight insignificant feature is of the utmost consequence to us, for without this protecting vail the heat we received on the earth would almost at once put an end to human existence, which could only linger, if at all, for a brief time in the Arctic regions, themselves become the seat of more than tropical temperature.

Let us now put a higher magnifying power on the telescope, and with it project upon the screen the portion of the eastern side, where the large spot already seen in Figs. 4 and 6 is coming into view. Here is the same spot magnified as seen at a certain given moment (for it is now perceived to be rapidly altering in shape) on the two successive days and also on September 22 (Figs. 7, 8, 9). We can now see that it is an immense ragged hole in the crust (or what at first looks like the crust) of the solar surface, followed by a number of smaller size. It is plainly a cavity, and not an elevation, for the slope is visible on the further or eastern side, and hidden by that next to us, and the same feature is repeated in the smaller ones. It is like looking across the edge of a shallow saucer, only that the outline is irregular, and that where the bottom should be there is nothing but the blackness of what seems an immeasurably deep chasm. To get rough measurement of its size we draw a line on the paper, and, with watch in hand, count the time it takes the spot to move across it, which is something like 4 seconds. Then note the time again from the moment the sun's western side touches the line till its eastern side has also passed over. This will be 128 seconds. The diameter of the spot, then, is (very roughly) to that of the sun as 4 to 128, or as 1 to 32, and $\frac{1}{32}$ part of the sun's diameter in miles (already given) is 860,000 ÷ 32, or over 26,000 miles. The diameter of this spot and its immediate connections, then, is over three times that of our earth, and this terrestrial globe might be dropped into the central chasm, as a pea into a thimble, without touching the sides! The whole surface about this vast cavity is changing and breaking up while we are looking on, and there must be a perpetual commotion there for which the most violent earthquake gives no comparison. What is going on in these wonderful regions? We must get nearer, and to do this employ the more powerful means to be now described, and which will virtually carry us to within a few hundred thousand miles of the surface.

Fig. 7.
SEPT. 19. 70.

Fig. 8.
SEPT. 20. 70.

Fig. 9.
SEPT. 22. 70.



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PROFESSOR EDISON'S NEW CARBON RHEOSTAT.

In quadruplex telegraphy it is vital to the working of the system to perfectly balance the electrical current.

The common method of doing this is to employ a rheostat containing a great length of resistance wire, more or less of which may be thrown into or cut out of the electrical circuit by inserting or withdrawing plugs or keys. This operation often requires thirty minutes or more of time that is or might be very valuable.

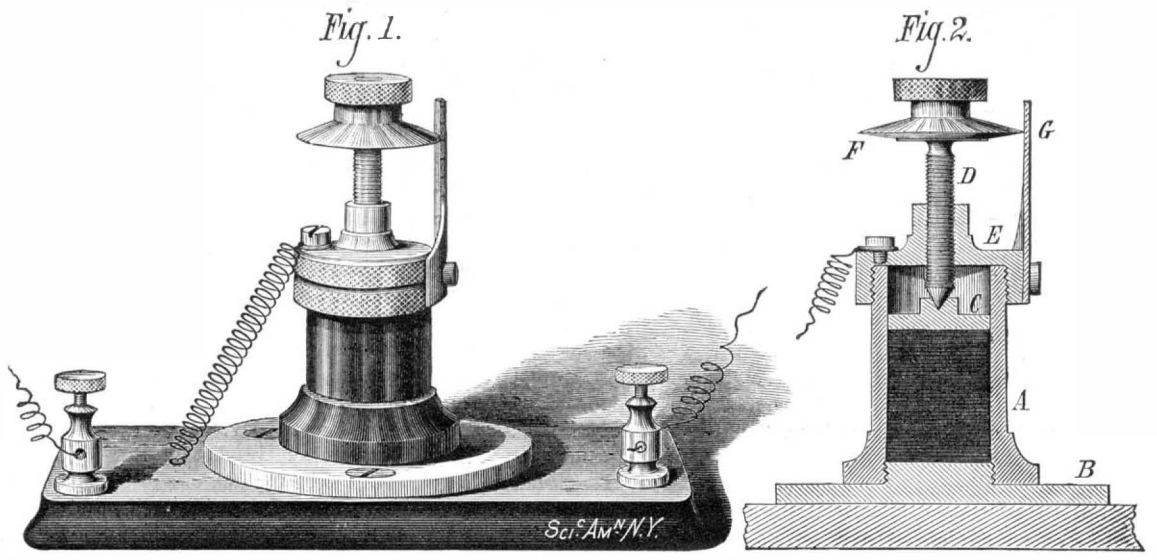
To remedy this difficulty Mr. Edison has devised the instrument represented in the engraving, Fig. 1 being a perspective view and Fig. 2 a vertical section.

A hollow vulcanite cylinder, A, is screwed on a boss on the brass plate, B. Fifty disks—cut from a piece of silk that has been saturated with sizing and well filled with fine plumbago and dried—are placed upon the boss of the plate, B, and are surmounted by a plate, C, having a central conical cavity in its upper surface. A pointed screw, D, passes through the cap, E, at the top of the cylinder, A, and projects into the conical cavity in the plate, C. The screw is provided with a disk, F, having a knife edge periphery which extends to the scale, G, and serves as an index to show the degree of compression to which the silk disks are subjected.

The instrument is placed in the circuit by connecting the cap, E, with one end of the battery wire and the plate, B, with the other end.

The principle of the instrument is identical with that of Mr. Edison's carbon telephone. The compression of the series of disks increases conductivity; a diminution of pressure increases the resistance. Any degree of resistance within the scope of the instrument may be had by turning the screw one way or the other.

In this instrument the resistance may be varied from 400 to 6,000 ohms, and any amount of resistance may be had by increasing the number of silk disks.

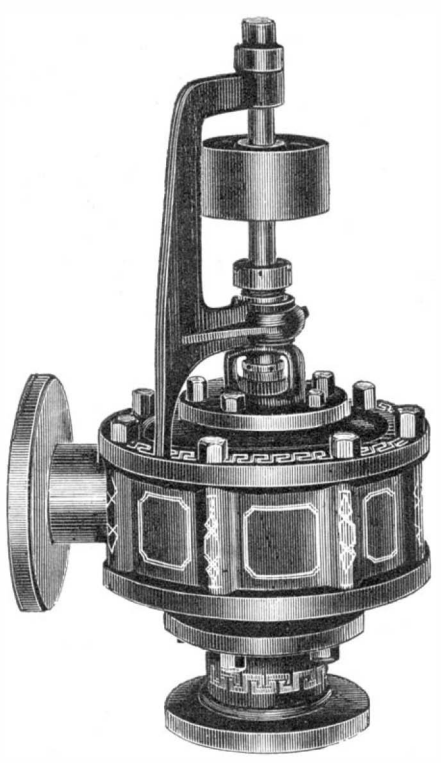


PROFESSOR EDISON'S NEW CARBON RHEOSTAT.

THE CHASE ELEMENTAL GOVERNOR.

The Chase governor is constructed on the following principles: First, to inclose the centrifugal mechanism in the same chamber with the governor valve; and, second, to locate the centrifugal force in the valve or valves themselves. The first is claimed to obviate friction of steam packing, and unbalanced pressure; for, since the centrifugal mechanism is itself immersed in the steam, there is no need of a steam-tight connection between it and the valve, and for the same reason there can be no unbalanced pressure. The avoidance of lost motion is accomplished in a manner claimed to be equally effectual. The governor valves, two in number, are themselves made to revolve about an axis in such a manner that the centrifugal force acts on them directly without the intervention of any supplementary parts whatever; they are, in fact, centrifugal valves. A spiral spring is employed as the complement of the centrifugal force, to open the valves when the speed slackens, and this spring is attached directly to the valves, stretching from one to the other across the axis of revolution.

In the annexed engravings, Fig. 1 is a vertical longitudinal section, and Fig. 2 is an end view of the interior parts, the cover of the case being removed to show the same. The governing mechanism consists of the hollow revolving flier, B, with its two pairs of flat hollow arms, C C C C, the two valves, D D, and the spring, E. The hollow arms, C, have ports, O O O O, near their outer ends, opening inward toward each other, and the two valves, D D, are flat blocks of metal, one being fitted between each pair of arms, so that by moving out and in they cover and uncover the ports. The steam, as shown by the arrows, enters the flier, B, through a pipe screwed into the case, thence passing through the hollow arms, C, and ports, O, into the interior of the case, A; from thence it passes out through the base flange to the engine. A ring on the open end of the flier, B, bears against a shoulder in the case, forming a metallic packing, which prevents steam passing to the engine, except through the governing mechanism.



THE CHASE ELEMENTAL GOVERNOR.

The valves, D D, as seen in Fig. 2, are pivoted and supported at F F, so as to move in arcs of circles. The spiral spring, E, Fig. 2, is attached to the valves, D D. The flier and valves are driven by the shaft, S. When the speed is too fast the valves, D D, fly out by centrifugal force and cover the ports, O, and when it is too slow, the spring draws the valves together so as to uncover the ports.

The upper valve, Fig. 2, has a slotted arm projecting downward from the pivot, F, and the lower valve has a similar arm projecting upward with a fork at right angles with the former, and furnished with a square swiveled block which plays in the slot of the upper valve, the object being to cause the two valves to move together. An equalizer of this kind is necessary to counteract the alternating action of gravity on the valves in their upper and lower positions.

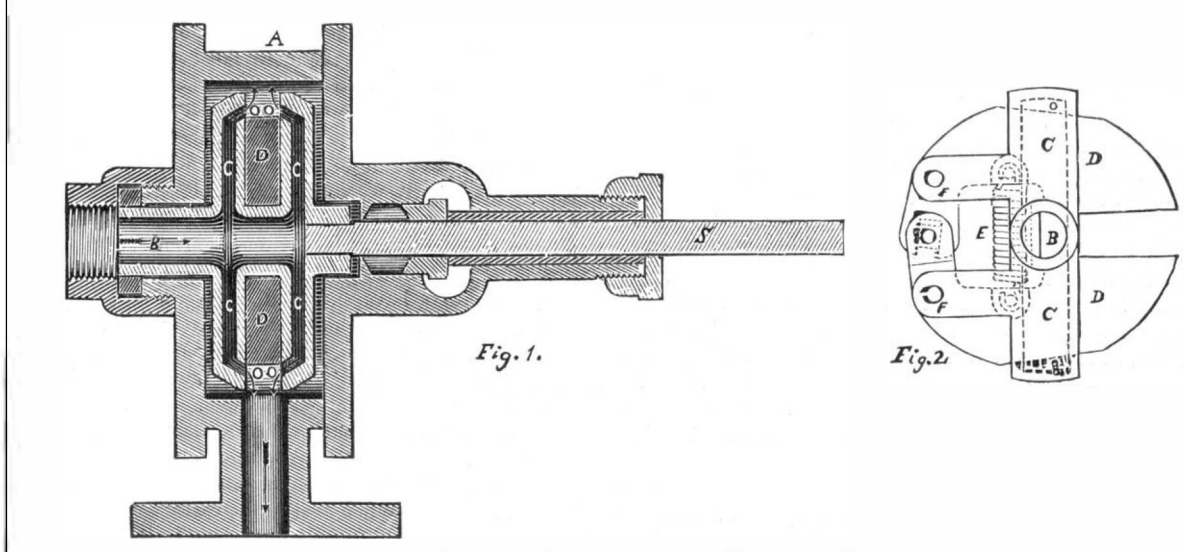
It is claimed that the two valves, being entirely guided and supported by the pivots, and suspended between two vertical valve seats, so that their weight does not bear upon the same, and with no attachments whatever, are as nearly frictionless as possible; and that as the spring is attached to the valves themselves, there can be no lost motion, whether the governor is new or old. The valves will act through minute distances with accuracy, which is the chief requisite of a good governor. The flier, with its hollow arms, lugs for pivots, etc., is cast in one piece, with nothing to unscrew or get loose. The interior parts are readily accessible by removing the cover of the case.

The working edges of the ports and valves are faced with composition to resist steam cut. The pivots have long bearings and very slight motion, and all parts are amply strong and heavy. The shaft is steel, and is supported by a long bearing on each side of the pulley.

We are informed that these machines have been in use for the past three years, having been applied to reversing elevator engines and in other situations, the most difficult that could be found, and have proved themselves capable of enduring the severest tests. The manufacturers believe them particularly adapted for marine engines, on account of their compact form, sensitiveness, and the fact that they cannot be affected by the motion of the vessel. They are also suitable for all portable and traction engines, as the position of the engine does not at all impair the efficiency of the governor.

Small sizes, down to three eighths inch, are made, as it is further claimed that the peculiar construction permits the very smallest size to work with the same accuracy as those of the larger sizes.

For further information address Chase Machine Company, 36 Charlestown street, Boston, Mass.



THE CHASE ELEMENTAL GOVERNOR.

Chinese Wine Powder.

A recent number of the *Journal Officiel* describes an extremely curious method of wine manufacture employed by those odd people, the Chinese, who make a powder or cake of what might be called the concentrated extract of wine. A little of this powder, or a pellet of the cake, dissolved in a glass of water, makes a beverage that is consumed in large quantities in China; and a beverage which, it is said, resembles more or less, as to flavor, the different sorts of wines or spirits. This drink is rather an alcohol than a wine, properly so called; and the powder of which it is composed is obtained by the pulverization either of oats or of barley or rye, or, indeed, of the three grains united (with or without the addition of aromatic or medicinal herbs), after having undergone a certain degree of fermentation.

The flour, or powder, thus obtained, is known in China under the name of *kin-tsee*, and when properly prepared it may be preserved for two or three years. Certain manufacturers in the Celestial Empire have a great reputation for the excellent quality of the *kin-tsee* that they produce, and many different processes are in use for the preparation of the powder, and for improving its flavor. Rice, very carefully cleaned, is also used for making different varieties of wines, and has this particular property, that although in certain methods of manufacture much water is used, its evaporation in this case becomes perfect, and the powder is sold in a state of complete dryness.

Amber Varnish.

Mr. S. Meredith says that the varnish he produces is capable of giving a very superior polish or surface, and is especially valuable for coach and other high-class work. In carrying out his process he first bleaches the amber by placing a quantity—about, say, 7 lbs.—of yellow amber in a suitable receptacle, such as an earthen crucible, of sufficient strength, adding 14 lbs. of sal gemmæ (rock or fossil salt), and then pouring in as much spring water as will dissolve the sal gemmæ. When the latter is dissolved more water is added, and the crucible is stood over a fire until the color of the amber is changed to a perfect white. The bleached amber is then placed in an iron pot and heated over a common fire until it is completely dissolved, after which the melting pot is removed from the fire, and when sufficiently cool the amber is removed from the pot and immersed in spring water to eliminate the sal gemmæ, after which the amber is put back into the pot, and is again heated over the fire until the amber is dissolved. When the operation is finished, the amber is removed from the pot and spread out upon a clean marble slab to dry, until all the water has evaporated, and is afterward exposed to a gentle heat to entirely deprive it of humidity.

To make a varnish, white amber prepared as above described is reduced to powder in a mortar, or otherwise, and

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is melted over a fire in a clean iron pot, and as much fine nut oil as will make it into a varnish is then added, after which the whole is well stirred until thoroughly mixed. The pot is then removed from the fire, and when the heat has sufficiently moderated, essence of turpentine is added to form a composition of the proper consistence for use. The following proportions answer well: White amber, 1 lb.; fine nut oil, 1 lb.; essence of turpentine, 2 lbs.

The Alkaloids of Opium.

Dr. Isaac Ott, who has been engaged in studying the effects of the various alkaloids of opium, which now number sixteen, publishes the results of his labors in the *Journal of Nervous and Mental Diseases*. Adding what was formerly known as to the action of these alkaloids to the information derived from a large number of experiments made by him, the author has been enabled to deduce the following conclusions:

1. *Cryptopia* is narcotic. It first excites, then depresses reflex action by its effect on the spinal cord; reduces the power of the motor nerves; abolishes sensation by its action on the spinal sensory ganglia, and lowers the heart beat by action on its muscular structure.

2. *Thebaina* is a spinal convulsivant, having no action on motor or sensory nerves or striated muscle. It reduces the heart beat by an action on that organ, and increases the pressure of blood by stimulating the cerebral vaso-motor centers.

3. *Codeia* is a spinal convulsivant and narcotic, producing a veratroid contraction of striated muscle, and depressing the heart beat by action on the cardiac muscle.

4. *Chlorocodeia* is a tetanic agent.

5. *Apocodeia* produces vomiting, coma, and death.

6. *Narceina* to cold-blooded animals acts as a soporific; to man it is a spinal convulsivant. It does not destroy the motor nerves; it produces veratroid contraction of the muscles and reduces the heart beat by stimulating the peripheral end of the pneumo-gastric.

7. *Papaverina* is narcotic and convulsivant; it diminishes the heart's contractions by peripheral action on the cardio-inhibitory apparatus; it also causes veratroid contraction of the muscles.

8. *Narcotina* is non-narcotic and a spinal convulsivant, producing veratroid contraction of striated muscle, and being an active agent in decreasing the heart beats by its action on the cardiac muscle.

9. *Cotarnina* is soporific, and, like curare, paralyzes the motor nerves.

10. *Hydrocotarnina* is a narcotic and convulsivant.

11. *Hydrochlorate of Cotarninic Acid* is a convulsivant and paralyzes the pneumo-gastric.

12. *Laudanosina* and *laudanina* are tetanic agents.

13. *Morphia* is a narcotic and spinal convulsivant; it produces veratroid contraction of muscle and reduces heart beat.

14. *Oxymorphia* acts like morphia, but is weaker.

15. *Apomorphia* is an emetic; it excites and reduces spinal reflex excitability, and diminishes the frequency of cardiac contractions.

16. *Meconin* to cold-blooded animals is a narcotic, but not to man in doses of two grains; it produces hyperæsthesia and paralysis of voluntary motion with general relaxation, and also a veratroid contraction.

The effect of any one of the opium alkaloids differs from the rest, or from that of opium itself; they all possess a dominant action on the nervous system, causing first increased exaggerated functions, and finally paralysis of them, if the dose be sufficiently large. This action, on warm-blooded animals, takes place both on the spinal cord and cerebrum.

Microscopy.

A New Improvement in the Microscope is reported from Germany. Herr I. Von Lenhossek has constructed an apparatus which permits no less than sixty microscopical preparations being observed in immediate succession, without the trouble of changing slides and readjustment of the object glass. Its construction is similar in principle to that of the well known revolving stereoscopes, and the inventor has given the new apparatus the name of "polymicroscope."

Remarkable Section Cutting.—At a conversazione following a regular meeting of the Quekett Microscopical Club, of London, in April, Mr. E. T. Newton exhibited thirty-three sections of the head of one cockroach (*Blatta Americana*)!

Modes of Reproduction in the Diatomaceæ.—In an instructive article in *Science Gossip*, entitled "What a Diatom is," by M. Deby, the author says: "We believe that other modes of reproduction exist in the *diatomaceæ* besides that of conjugation, but the biology of these little beings is much too imperfect to enable us to hazard any profound hypothesis on this subject. It is evident that all the frustules do not finish by conjugating; this is highly improbable when we consider the rarity of that phenomenon. Some other explanation is necessary to account for the variations in the dimensions we meet with in the different individuals of the same series other than that of reduplication, as without it those frustules that escape conjugation would go on diminishing in size indefinitely, and we know from observation that every species of diatom possesses a maximum and minimum of dimension which it never passes. The rapid appearance of species where they did not previously exist, their periodic succession at determined seasons, and which we have never been able to find in the intervals in the same locality—this presents the possibility of a mode of generation which is only yet suspected, by germs, by micro- or macro-zoospores, possibly even in the first case with the formation of zygozoospores, as it takes place among many of the inferior algæ which live under the same conditions as the diatoms.

"Here we enter a field of study of the greatest interest and novelty to every naturalist furnished with a good microscope, and possessing time and patience for such researches; and we dare affirm that any member of a microscopical society who shall follow with care the entire life cycle of a single species of diatom (even the commonest) will *probably render a greater service to science than if he had described and figured hundreds of frustules from the four quarters of the globe.*"

We have italicized the last sentence because we like its good, practical common sense. The statement applies not only to diatoms, but to every branch of natural history.

How to view Rotifers.—A correspondent of *Nature* gives the following advice, as the result of his practical experience, in regard to the study of those lively little animalcules—the rotifers. With ordinary *compressoria* and "live boxes," these quick-moving animals are troublesome to see. The following is therefore recommended:

Take a plane glass slide; on it drop one or more of the rotifers in a drop of water about half an inch in diameter, and draw off the surplus water, if any, carefully with the empty pipette. Then fray out a very, very small portion of cotton wool until it is much extended, and spread out and lay this on the drop. Upon that lay the thin microscopic glass (the thinner the better), and then set up the capillary attraction by gently touching it with a needle. Draw off any superfluous water from the edges with the pocket handkerchief, and you will have a little wilderness of wool in which the rotifer is restrained in its movements, protected from pressure, and within reach of very high powers. The amount of wool depends on the size of the rotifer. *Hydatina* requires more depth than *rhinops*. The same plan answers equally well for all roving animals. The *poduridæ* in particular when placed in deep glass cells are easily seen by this apparatus, and it saves many a weary and vexatious five minutes with the *compressorium*, which even at the best requires with living animals extraordinary patience. The rotifers are easily found and secured with the pipette after a very little practice.

Wet Method of Preparing Objects for Mounting.—Mr. Stokes, in an article on this subject in *Science Gossip*, proposes a method by which the ever-recurring air bubble may be gotten rid of. The only piece of apparatus required is a single test tube. Into this the sections or parts of animals and plants are placed, and the tube half filled with distilled water made acid with a few drops of nitric acid. The use of the latter is not a necessity, but quickens the process.

The liquid is now heated almost to the boiling point for some 5 to 15 minutes. The acidulated water is then poured off, and the tube filled with hot distilled water and gently shaken once or twice. The water is now carefully poured off and replaced by methylated spirit; this is heated almost to the boiling point for about 5 minutes. It is then poured off, the tube about a quarter filled with ether, and the contents heated gently by immersing the end of the tube in a cup of hot water for half a minute. Ether, being inflammable, should not be heated by nor brought near a light. Now pour off the ether and quickly drop in a quantity of turpentine that will a little more than cover the objects. The whole operation is now finished, and every particle of air and water originally in the object has been replaced by turpentine. The objects are now ready for mounting in Canada balsam or dammar. Objects, such as some parts of insects, which are not transparent, need, as usual, previous maceration in potash solution. The author very correctly remarks, we think, that benzole would doubtless do equally as well as ether. If it be desired to stain the specimens, this is best done by adding the dye to the methylated spirit.

Is the Moon Inhabited?

The writer of these remarks has repeatedly had the above question put to him: in return he would put the following: What evidence have we of the habitability of the moon? Some writers have indulged in the speculation that, with the large telescopes now in existence, armies of soldiers, troops of elephants and such like may be detected on the march, and others have surmised that buildings might be seen and the styles of architecture ascertained. The ideas such extraordinary statements may induce in the minds of the uneducated render it desirable to examine a little into the probability of obtaining such results. The diameter of the moon is 2,163 miles; but, as it never remains at the same distance from the earth, being sometimes nearer and sometimes further, it never presents the same apparent diameter as seen in the sky. When nearest the earth it is seen under the largest angle, or 33′ 33·20″; but when furthest from the earth it is seen under the smallest angle, or 29′ 23·65″. Now it follows from the relation between the real and apparent diameters of the moon, at its mean distance from the earth, that a second of arc, written thus (1″), is the angle under which a mile and a little more than the tenth of a mile, written thus, 1·139, is seen at the center of the moon's disk; again, as a second is pretty well the smallest distance that can be clearly discerned, it follows that a building on the moon to be clearly seen—we may say to be seen at all—must be about a square mile in extent, and then it would be seen only as a spot, light or dark according as the materials of which it was built reflected a larger or smaller quantity of light.

There are some very level plains on the surface of the moon, surrounded by mountains. One such plain has been very carefully examined; it is about 60 miles in diameter. The mountain wall rises to a height of 3,000 feet on the south, 3,200 on the west and north, and 3,800 on the east. On the wall are four lofty pinnacles of rock, three on the west and one on the east. The highest, which is on the east, rises to the height of 7,418 feet above the level interior; the next highest is on the west; its altitude is 7,258 feet; the two lower rocks are respectively 6,396 and 5,128 feet above the interior.

Let us place ourselves, in imagination, within the confines of this mountain cinctured plain and view from its center its girdling rocks at a distance of 30 miles; they would appear from this point under a vertical angle of very little more than one degree, and the highest rock on the east would subtend an angle of less than three. It is believed that no other portion of the moon has undergone so close a scrutiny as this. For three years has its surface or floor been examined, during sunshine upon it, with telescopes able to bring small objects into view, and the results carefully discussed, from which it appears that nowhere on this plain has anything at all approaching the nature of a building or a collection of buildings been detected. At various intervals, as many as 36 small white spots have been seen during the three years, but never the whole together. Ten of these spots have been ascertained to consist of volcanic cones, the bases having an average diameter of about one mile; the base of the largest, near the center of the plain, certainly does not exceed two miles. With the exception of these natural productions nothing sufficiently elevated above the surface to cast a shadow at sunrise or sunset exists on this plain; there are, indeed, some remarkable variations of brightness upon it: for example, about the middle of the day, when the sun is highest, it appears very dark, almost black, but there is nothing to induce the opinion that a patch of a different tint exists anywhere on this plain, such as might be supposed to arise from a collection of buildings covering a space of four or five miles in extent. From such facts as these, the results of close and unremitting observation, into which conjecture is not permitted to enter, we are forced to the conclusion that the evidence we possess of the habitability of the moon is very scanty. Indeed, it does not even furnish a clew by which we might institute a series of observations likely to lead to a positive result.

It must, however, be remembered that the walled plain, Plato, to which the foregoing remarks refer, is but a very small part of the moon's surface, and it would be manifestly unsafe to draw any conclusions on the above question from the examination of so small a part, carefully as that part has been examined. While there may be great difficulty in detecting any evidence of artificial construction, it is beginning to be ascertained that there is not so much difficulty as formerly in detecting instances of physical change. The discovery in May, 1877, by Dr. Klein, of a dark spot northwest of Hyginus, where nothing of the kind had been seen before, combined with the celebrated case of Linné, will go far to show that changes of a physical character and of sufficient magnitude to be seen from the earth are now in operation, and will doubtless open up a line of research by which we may learn something of the nature of the forces at work within the moon, and form more accurate notions of our satellite than those to which we have been treated of late years, such as a "burnt up cinder," "a dead world," or one reduced to its last stage of existence. So far as we are able to judge of the mundane processes going on around us, there is a perpetual cycle of recurring physical events by which decay is replaced by renovation. We have, on our own globe, instances of very ancient formations, and others of a most recent date: the same alternation of ancient and recent tracts is found on the moon, and it would not be difficult from careful observation to assign the epochs of some of the most striking series of changes. Indeed, a chronological arrangement of the large gray plains, of the craters in their neighborhoods previously existing, and of those opened upon their surfaces, has been attempted upon a large scale, but it is evident that the study of the more minute objects is likely to be attended with results upon which a more correct system of lunar topography can be raised, which, in its turn, will conduct the student to a satisfactory system of selenology.—*English Mechanic.*

New Mechanical Inventions.

Mr. Robert H. Ramsey, of Philadelphia, Pa., has patented a new Car Transfer Apparatus. The invention is an improvement upon the patent of May 30, 1876, to the same inventor. While preserving the same general principle of shifting the trucks shown in said patent, the present invention consists in arranging the side trucks and the general level of the depressed portion of the main track upon an incline with the steepest grade in the side tracks just where the ascending incline of the main track commences, by which arrangement the shifting of the truck is effected by the gravity of the car and without the aid of a locomotive.

Mr. Royal Gurley, of Meadville, Pa., has patented a new Railway Switch Bar, which is used independently of ties or sleepers, for connecting switch rails so as to hold them parallel and thus preserve the gauge of the track. The rails are connected by tie rods and nuts which slide on the latter. The nuts are provided with claws that embrace the base of the rails, and the latter are held apart by slotted tubes which inclose the tie rods and whose ends enter recesses in said nuts.

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A new Cotton Press has been invented by Mr. Sampson Pope, of Williamsburg, Miss., in which the follower receives greater speed when the power required is light, but is moved slower when the resistance increases and a greater power is needed.

Mr. Lafayette A. Hays, of Greenville, N. H., has patented a new Saw Filing Machine, which consists of an adjustable saw clamp, file holder, and file guide for holding the saw blades and uniformly filing the teeth of the same at any angle desired, horizontal or vertical.

A new Steamer for Feed has been patented by Messrs. F. E. Mills and C. Clager, of Ann Arbor, Mich., which may be used also for laundry purposes, and which is so constructed as to be easily portable.

In an improved Valve Gear for Steam Engines, patented by Mr. Charles A. Smith, of Columbus, Ohio, there is a new construction of the link and of an angle bar employed in connection therewith, in lieu of a link block, the whole forming a simple and accurately working reversing mechanism.

A new Wrench has been patented by Mr. John S. Birch, of Orange, N. J., which will adjust itself to various sized objects and may be securely locked in position.

The new feature in an improved Earth Auger, devised by Mr. B. F. Mull, of Merced, Cal., is the bit, made V-shaped, having a screw point formed upon its angle, and having the forward edges of its arms or wings made sharp and extended beyond the circumference of the tube to which the shanks of said bit are attached.

A new Car Coupling, patented by Mr. Geo. E. Weber, of Opelika, Ala., is arranged to couple cars of different heights on any curve, without the brakeman going between the cars, and is also so constructed as to connect cars having the common pin and link coupling.

Mr. Lewis T. Cornell, of Chicago, Ill., has devised an ingenious implement for extracting, uncapping, loading, cutting, creasing, and closing breech-loading cartridge shells. It embodies many new and useful contrivances, and will doubtless be found valuable by sportsmen.

Mr. Edward Henderson, of New York city, has invented a Clamp, to be used by gold leaf manufacturers for holding the mould while the leaves are removed to be cut into sizes and placed in books.

Mr. William Davies, of Henderson, Ky., has improved the construction of the Tobacco Stripping and Drying Machine which he patented August 14, 1877, so that the leaves are stripped from the stems and flattened and dried in a very effective and ingenious manner.

Mr. William G. Raoul, of Macon, Ga., has patented a device for adapting air brakes, as now used under the several existing patents, to mixed trains, or to render it possible for freight or other cars not supplied with air-brake attachments to intervene between the engine and such cars as may be supplied with air brakes, without rendering the latter inoperative.

Mr. Lorenzo D. Hurd, of Wellsville, N. Y., has patented a new Car Truck, the object of which is to reduce friction in passing around a curve. There is no slipping of the wheels on either side, as they are fixed on independent axles.

Messrs. Robert L. Vernon and George W. Vernon, of Greensboro, N. C., have patented a new Railway Switch Signal, in which a rotating lantern is employed to give different colored lights and thereby indicate whether the switch is open or closed. The red or "danger" signal is given by causing red glasses to appear in front of the lantern lamp whenever the switch rails are not properly adjusted and the switch lever is not locked to the switch stand.

Joseph Saunders, of Brooklyn, New York, has invented a Steam Valve, which is applicable to steam pipes of all kinds, and by which the water of condensation may be collected and discharged, and thereby steam of greater dryness furnished than customary with the common steam valve. The steam valve has an enlarged portion or pocket below the valve seat, a discharge opening in the pocket, and a discharge valve or cock below the pocket for letting out the water of condensation collected in the pocket of the main valve.

A patent has been issued to Alexander Marengo, Joseph Marengo, and R. Marengo, of Montreal, Quebec, Canada, for a Cheroot Machine, which is an improvement on the cigarette machine for which letters patent have been granted them heretofore, dated May 23, 1876, and numbered 177,732, so that the class of cigars known as "cheroots" or "dovetails" may be manufactured thereon with convenience and rapidity. The machine has two top rollers, and an endless belt, which is stretched over the top rollers and over a vertically adjustable bottom roller, whose supporting frame is secured on the fixed side standards of the machine by set screws. One of the top rollers is supported in fixed arms, while the other roller is mounted on pivoted arms, which are connected with a suitable treadle mechanism, so that by pressing the treadle down the rollers will be brought closer to each other and inclose the tobacco placed in the bight formed by the belt between the rollers.

Joseph Koenig, of Indianapolis, Ind., has patented an Awning which may be adjusted into different positions, so as to shut out the sun or light, either partly or entirely It is also readily arranged so as to be closed at either side, and admit a draught of air at the opposite side. The awning may be used as an exterior curtain and rolled up entirely, so as to be out of the way, being protected by the guard piece at the top of the window casing.

A machine for Pasting Together and Drying Rolls or Continuous Sheets of Paper and other Fabrics, patented by Joseph Caller, of Cambridge, Mass., consists of an arrangement of pasting rolls, a sizing roll, and drying cylinders, for simultaneously drying both sides of the paper.

Sern P. Watt, of Jamestown Neb., has patented an improved Velocipede of that class known as four-wheeled or carriage velocipedes, and which are operated by lever action, worked by hand, and guided by means of the feet. The invention consists of a front axle, with stirrups for the feet in connection with a compound lever connection with the double crank of the rear axle. The hubs of the hind wheels have inner boxes, with ratchets that engage spring pawls of the rear axle, to produce the revolving of the rear driving wheels.

Mr. John Hill, of Columbus, Ga., has patented a Copying Press, which furnishes a convenient means for securing privacy for letter copying books against meddlers, as well as security for the same against loss by abstraction. It consists in combining a locking device with the letter press which locking device holds the platen or movable follower to its tightened adjustment upon the book, so that the latter cannot be removed except by the proper person having possession of the key.

Mr. Daniel L. Holden, of Philadelphia, Pa., has devised an improved form of refrigerator for cooling a non-congealable liquid by the evaporation of a volatile fluid; an improved form of condenser for again liquefying the volatilized gas; and an improved form of congealer for freezing cans of water immersed in a tank of refrigerated non-congealable liquid; the said features being improvements upon an ice machine previously patented by Mr. Holden, and illustrated on the first page of this paper in the issue of March 16, 1878. The improvements are protected by three patents.

A new Locomotive Smoke Stack, patented by Mr. Isaac H. Congdon, of Omaha, Neb., is so constructed as not to choke the draught, to arrest sparks, and so that it may be applied to any smoke box.

Communications.

THE ELECTRICAL INDICATOR FOR SHOWING THE ROTATION OF THE EARTH.—A NOTE FROM PROF. MAYER.

To the Editor of the Scientific American:

The reading of the article by Mr. George M. Hopkins on the "Electrical Indicator for Showing the Rotation of the Earth" has suggested an addition to the apparatus which will render the experiments with it more delicate, and make manifest the rotation of the earth after the gyroscope has run for only a minute. If he will attach a plain or concave mirror to the frame of the gyroscope and reflect a beam of light from the mirror to a screen he will have an index which may be of considerable length, of no weight, and have no momentum. If the distance of the screen from the mirror is, say, ten feet, then the spaces over which the light passes on the screen will be the same as those which would be passed over by a rod 20 feet long attached to the gyroscope as an index. This is because the angle of deflection of the reflected beam is always double of that of the angular deflection of the mirror.

The apparent angular motion per hour of Foucault's pendulum and of his gyroscope for showing the earth's rotation is equal to 15° multiplied by the sine of the latitude of the place where the pendulum or gyroscope is mounted. Calling the latitude of New York 40° 43′, we have 9° 47′ as the amount of hourly motion in azimuth. But as the reflected beam moves through double the angle of the mirror attached to the gyroscope, we have 19° 34′ as the hourly angular motion of the reflected beam of light. In one minute of time the beam will move through $\frac{1}{60}$ of 19° 34′, or through 19½ minutes of arc. This angular displacement of the beam will equal ·678 of an inch on a screen ten feet distant from the mirror. In ten minutes of time we will consequently see the spot of light on the screen move through $6\frac{78}{100}$ inches. This quantity, however, gives the motion during the first ten minutes, if we suppose the beam to have started for a direction at right angles to the screen. The distance through which the spot of light travels will be greater during succeeding 10 minutes of time, for the distances will be the tangents of the angular deflections. If, however, the screen have a cylindrical surface with a radius equal to the distance of the axis of rotation of the gyroscope to the screen, then the spot of light will travel over equal distances in equal successive portions of time.

For accurate measurements of the motion of the gyroscope it will be better to place a horizontal scale of equal parts facing the mirror at the distance of, say, five to ten feet, and view the reflection of this scale from the mirror by sighting through a telescope with cross threads in its focus. With such an arrangement (see Article XI. of the "Minute Measurements of Modern Science," in the SCIENTIFIC AMERICAN SUPPLEMENT, by the writer) two or three minutes' observation on the motion of the scale over the cross threads of the telescope will suffice to give the amount of angular motion, which may be compared with that which theory requires, and which is computed by any one who has a table of natural sines. He will find the sine corresponding to the angle of the latitude of the place, and multiply this by 15° (the hourly angular motion at the poles of the earth); he will then take $\frac{1}{60}$ of the product for the angular motion in one minute, and double this result to allow for the doubling of the angle of reflection.

Foucault suspended his gyroscope by a strand of untwisted silk fibers, and if Mr. Hopkins will adopt this mode of suspension in place of the steel point, he will get rid of the friction, which should be avoided. There is a good description of Foucault's gyroscope, with four engravings, in Arago's "Astronomie Populaire," volume 3, page 50, *et seq.*

I have during the past winter repeated the Foucault experiment with the pendulum, and the apparent hourly angular motion of the instrument corresponded quite well with the theoretic value. The bob of my pendulum was a thirty pound cannon ball, which I floated in a hemispherical bowl containing mercury, and thus found out the position the ball has when its center of gravity is in a vertical line with its center of figure. The ball was suspended in the same position it had when it floated in the mercury.

ALFRED M. MAYER.

South Orange, N. J., July 1, 1878.

Electrical Indicator for Showing the Rotation of the Earth.

To the Editor of the Scientific American:

In my article on an "Electrical Indicator for Showing the Rotation of the Earth," in your issue of July 6, I mention that the apparent motion of the index is 15° per hour. With this instrument this would be true only at the poles, at the equator it would be 0°, and in this latitude it would be about 9°.

I intend soon to furnish you with sketches of another form of instrument, which will indicate the full diurnal motion when placed at any point on the earth's surface.

GEO. M. HOPKINS.

To the Editor of the Scientific American:

I translate the following from Aristotle, De Mirabiliis, Ausc., page 189, tom. 16, Lipsiæ. Might it not have been gallium of which he wrote?

"They say that Celtic tin is melted quicker than lead. A sign is that it appears to be melted in water. It stains (or sticks to the vessel) quickly. But it is melted away or is liquid in the cold, when it should be congealed."

In the same vol., cap. 36, *Quæst. Mechan.*, you will find the reasons why bodies on eddies of water move to the center, that are the same in part given by some writer lately, perhaps in your journal. J. F. G. MITTAG.

Counterfeiting American Goods.

In reply to the charge that American goods sent to South American markets are not equal to the samples exhibited by agents, a correspondent of the *Evening Post* calls attention to the fact that enormous quantities of cheap imitations of American goods are made in England and Germany to be shipped to the West Indies and South America; and not only is the general appearance of American goods imitated, but the brands, labels, and trademarks of American manufacturers are placed upon the spurious products. In the single district of Elberfeld, in Rhenish Prussia, over thirty factories were at one time at work forging "American" implements, such as axes, machetes, hatchets, and the like, with exact imitations of the private marks of reputable American firms. Law suits against some of the worst of these offenders have resulted in their conviction, but the petty fines imposed by the German courts have had little effect to stop the outrage. The trade is kept up, and American manufacturers find everywhere in the West Indies and Spanish America miserable imitations of their goods, bearing their own names, brands, and trademarks.

The Steam Street Railways of New York City.

It is surmised that the purpose of the constructors of the Metropolitan Elevated Railway is partially moral and pious, at least for the present. Rendering everybody indignant and extremely uncomfortable along the line and in the vicinity of the road by running trains of the noisest and most damaging sort during week days, and intermitting them on Sundays, they hope, it is rumored, to make the Sabbath what the word implies. In this they succeed; they have made Sunday a day of rest and real enjoyment—a day of gratitude and benefaction. The most secular of the West Siders speak of it as blessed and blessing, and admit that never, until the running of the Metropolitan trains, have they fully appreciated it. They are thankful from the bottom of their hearts for Sunday, and wish most sincerely, so far as the railway is concerned, that Sunday might be perpetual. They attend church less than they have done, staying at home to enjoy comparative quiet, and to realize wholly their deliverance from the infernal trains. Many of them are compelled to employ the day in sleep, as they cannot sleep with any satisfaction during the week. We like to have the railway people credited with good intentions, but we fear that they suspend the trains on Sunday for the nonce, only to prevent the indignant howl which they know would rise from the orthodox on account of the necessary interruption of service in all the churches within any ordinary distance of Sixth avenue. A common prayer nowadays on the West Side is, "Good Lord, deliver us from the din and torture of the elevated railway."—*N. Y. Times.*

THE London *Telegraphic Journal*, in a recent article upon the admitted pre-eminence of telegraphic improvements and advances in the United States over all other nations, expresses the opinion that this superiority of the Americans is due to the excellence of our patent laws, which encourage inventors to obtain patents, and place no restrictions upon them after they are obtained.

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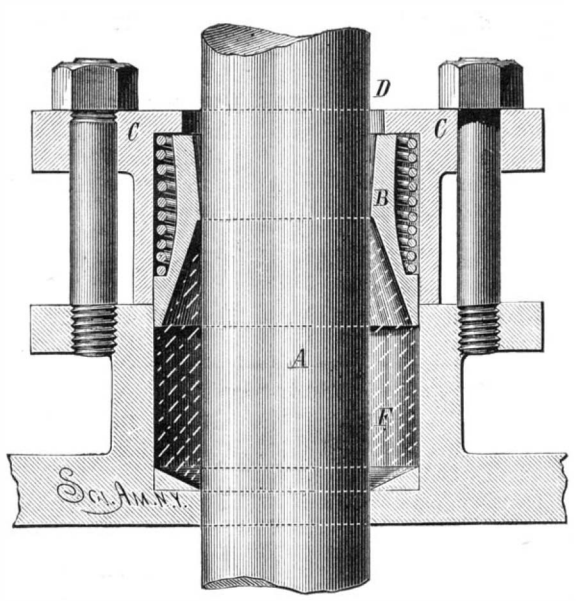
IMPROVED PISTON ROD STUFFING BOX.

We illustrate herewith an improved stuffing box for the piston rods of steam cylinders, which is so constructed at the cylinder heads as to be self adjustable without requiring the continual screwing up of the box to prevent leaking of the same. The inventor claims that the packing may be used as long as a single circular strand remains around the piston rod, keeping the stuffing box always perfectly steam tight.

A is a cylindrical cup which is fitted accurately to the piston rod so as to hug the same, and is made tapering toward the packing placed in the stuffing box of the cylinder head. The cup is applied by the gland, B, in which is a shoulder, C, which retains the cup in such position that its tapering end projects into and slides in the stuffing box. Between the shoulder and outer rim of the cup a spiral



PISTON ROD STUFFING BOX.

spring is interposed as shown. This spring is of such strength that it presses the cup tightly on the packing as soon as the steam is shut off. It does not, however, overcome the pressure of the steam which causes the packing to press against the concave surface of the cup and so hug the valve stem tightly. In this way the blowing through of the steam is prevented after the packing becomes worn and does not tightly fill the stuffing box. The interposition of the packing prevents the speedy corrosion of the spring by cutting off access of the steam to it. The arrangement of parts also enables the flange, C, to be fitted loosely to the piston rod, thus avoiding friction at that point.

The inventor informs us that he has had the device in use on locomotives on two railroads for two years, and that it effects a saving of fifty per cent in packing. He has used it on one side of his engine, with the ordinary stuffing box on the other, and he has found that after running down long grades when the old fashioned stuffing box would heat the piston so that oil poured on the rod would smoke, the parts on which the new box was arranged would be cooler than before steam was shut off at the top of the grade. For further particulars relative to sale of patent, address the inventor, Mr. Joseph M. Searle, Stanhope, Sussex county, N. J.

Wandering Needles.

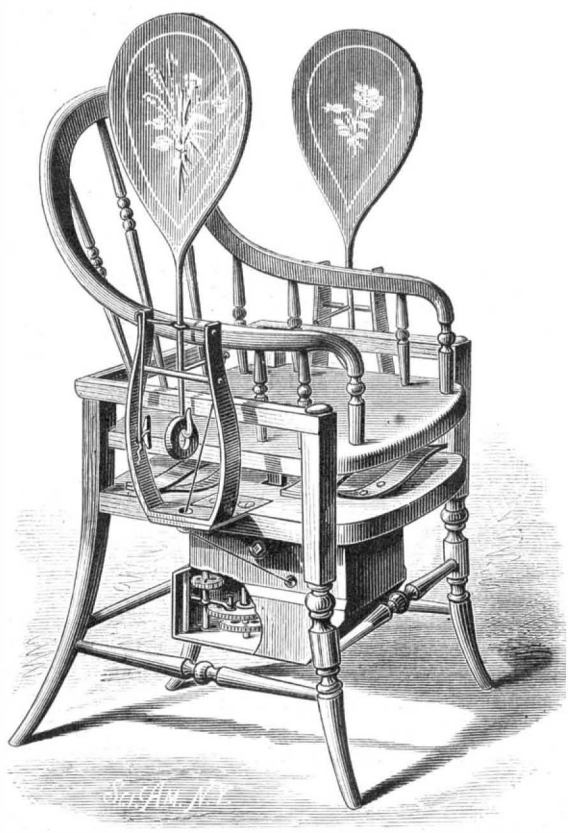
The vagaries of needles which have been introduced in the body, and have escaped immediate removal, have in all ages attracted the attention of collectors of the marvelous in medicine. Hildanus related an instance of a woman who swallowed several pins, and passed them six years afterwards; but a more remarkable instance of prolonged detention was lately recorded by Dr. Stephenson, of Detroit—that of a lady, aged seventy-five, who last year passed, by the urethra, after some months' symptoms of vesical irritation, a pin which she had swallowed while picking her teeth with it in the year 1835—forty-two years previously. Occasional pain in the throat was the only immediate symptom, but in 1845 she was seized with severe gastric pain, which passed away, and she had no further symptoms until hæmaturia in 1876. This curious tolerance of such foreign bodies exhibited by the tissues is often observed in lunatic asylums. M. Silvy recorded some years ago the case of a woman who had a *penchant* for pins and needles so strong that she made them, in effect, part of her daily diet, and, after her death, fourteen or fifteen hundred were removed from various parts of the body.

Another case, almost as striking, has been recorded by Dr. Gillette—that of a girl in whom, from time to time, needles were found beneath the skin, which they perforated, and were removed by the fingers or forceps. Concerning the way in which they had got into her system no information could be extracted from her. She was carefully watched, and in the course of eighteen months no less than 320 needles were extracted, all being of the same size. Most were black and oxidized, but some had retained their polish. The majority were unbroken. They passed out of various parts of the body above the diaphragm at regular intervals, but in a sort of series, and always in the same direction. Most escaped in the region of the left nipple, and a few escaped in the arm, axilla, thigh, temple, and cheek. Sometimes several passed out of the same opening. The largest number which escaped in a single day was sixty-one. A curious phenomenon preceded the escape of each needle. For some hours the pain was severe, and there was considerable fever. She then felt a sharp pain, like lightning, in the tissues, and on looking at the place at which this pain had been felt, the head of the needle was generally found projecting. The needles invariably came out head foremost. No bleeding was occasioned, and not the least trace of inflammation followed. The doctor in attendance extracted 318. They were sometimes held firmly, and seemed to be contained in a sort of indurated canal. It was conjectured that they had been swallowed with suicidal intentions; but, on the other hand, the way in which the needles escaped in series, and their direction with the head outward, suggested that they had been introduced through the skin. That little weight is to be attached to the place at which the needles escape as proof of their mode of introduction is evident from a case recorded by Villars of a girl who swallowed a large number of pins and needles, and two years afterward, during a period of nine months, 200 passed out of the hand, arm, axilla, side of thorax, abdomen, and thigh, all on the left side. The pins, curiously, escaped more readily and with less pain than the needles.

Many years ago a case was recorded by Dr. Otto, of Copenhagen, and mentioned at the time in the *Lancet*, in which 395 needles passed through the skin of a hysterical girl, who had probably swallowed them during a hysterical paroxysm; but these all emerged in the regions below the level of the diaphragm, and were collected in groups, which gave rise to intlammatory swellings of some size. One of these contained 100 needles. Quite recently Dr. Bigger described before the Society of Surgery of Dublin a case in which more than 300 needles were removed from the body of a woman who had died in consequence of their presence. It is very remarkable in how few of the cases the needles were the cause of death, and how slight an interference with function their presence and movement cause. From time to time their detection by a magnetic needle is proposed as a novelty; but, as Dr. Gillette reminds us, this method was employed by Smee nearly forty years ago, and has often been adopted since.—*Lancet.*

IMPROVED AUTOMATIC FAN.

An ingenious device of timely interest now that the hot weather is at hand has been invented by Mr. Gustav A. C. Meyer, its object being to enable a person to fan himself without any of the usual muscular exertion. The invention may also be used to communicate power to sewing machines and other light apparatus. As shown in the engraving, the seat frame is guided by anti-friction rollers in rails of the corner posts of the chair. The lowering of the seat frame by the weight of the body causes the engagement by a fixed



IMPROVED AUTOMATIC FAN.

vertical rack bar of the seat with a suitable transmitting wheel train and mechanism. The rack bar is guided along an anti-friction roller bearing on its rear side, and the seat and rack bar are elevated by the spring by raising the body from time to time off the chair. The speed of the transmitting mechanism is regulated by an anchor escapement and fan governor.

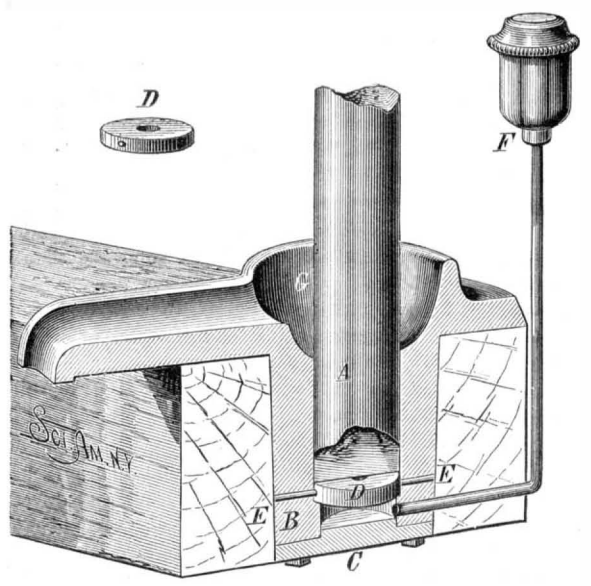
The inventor states that 25 minutes are required to cause the seat of the chair, represented in the illustration, to descend to its full extent, and during this period 1,257 strokes of the fan are made. It will be understood that the user of the device has simply to sit down and the motion of the fans at once automatically begins.

Patented May 7, 1878. For further particulars address Mr. G. A. C. Meyer, 20 Bowery, New York city.

IMPROVED STEP BOX.

The annexed engraving represents an improved device for lubricating the shaft in the step box, the construction and advantages of which will be readily understood from the following description: A is the lower end of a vertical shaft, B the step box, and C the bearing bar. The step block, D, is dropped into the box, and is sustained by the shoulder and fixed by pins at E. Beneath the block is an oil chamber, supplied with oil by an elevated cup, F, through the pipe shown. The oil is forced into the step box by capillary attraction and by the pressure of that contained in cup, F, and any surplus enters the annular cup, G, and runs off through the spout shown.

It will be observed that the center bearing is left intact, and the part of the shaft exposed to the oil hole is carried around into contact with the bearing surface of the box,



COLLET'S IMPROVED STEP BOX.

so that it wears equally with the rest, and also carries oil by mechanical action between the surfaces. As one hole is made eccentric, the oil will cause indirect contact with the part of the lower end of the shaft that comes in direct contact with the face of the bearing block, and consequently the introduction of oil between the surfaces is positive, and it will spread out over the whole of the bearing surface by capillary attraction.

Patented April 30, 1878. For further information address the inventor, Mr. John W. Collet, Upper Alton, Madison county, Ill.

Heat Conductivity.

The conduction of heat by substances that are poor conductors has recently been investigated by M. Less, in the laboratory of M. Wiedemann, for the same purpose as Hopkins had in view, and by a similar method to the one adopted by that experimenter. The substances examined were varieties of stone and wood. Plates were cut off them and placed on the bottom of a vessel equally heated with steam. On the other free surface was placed a soot covered copper plate. In a dry inclosed space, protected from all external radiation, a thermopile was exposed at different distances to the radiating copper plate, and from the deflections of the galvanometer inserted in the circuit, after a short exposure (always the same), the heat conductivity of the plate under examination was determined. The experiments were performed with great care, and are detailed in a recent number of the *Annalen der Physik.* We give the following table of results (in it the conductivity of the best conductor is put = 1000):

Substance.	Sp. Gr.	Conductivity.
Marble from the Pyrenees	2·616	1000
Saxon granite (containing albite)	2·629	804
Carrara marble	2·668	769
Marble from Italy	2·682	763
Basalt of Idar, near Oberstein	2·712	726
Seeberg fine grained sandstone	2·130	721
Granite from the Thuringian forest	2·545	713
Strehlen sandstone	2·324	701
Red gneiss of Tharandt	2·540	696
Nephalin—Basalt of Mitterteich	2·853	690
Serpentine of the Saxon Erzgebirge	2·418	678
Gneiss of Tharandt	2·654	673
Carlsbaden Shiver	2·731	537
Sandstone of Postelwitz	1·997	487
Clay slate from the Schwartal	2·685	469
Sandstone with kaolin cement	1·951	420
Common clay	2·003	275
Maple wood (with the fibers)	0·634	192
Oak wood (with the fibers)	0·621	161
Box wood (with the fibers)	0·790	135
Box wood across the fibers = the rings	0·754	96
Oak wood across the fibers = the rings	0·508	86
Maple wood across the fibers and rings	0·571	86
Maple wood across the fibers = the rings	0·607	85
Oak wood across the fibers and the rings	0·571	75

The numbers obtained for the stones show that, in general, density and compactness greatly favor the passage of heat; still, the values of the conductivity by no means depend on the specific gravity alone. The stones of crystalline texture conduct better than those mechanically mixed, and the stones with fine grains better than those with coarse. The few observations made on woods show that in them, as was long

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since demonstrated by Tyndall and others, there is a much more rapid passage of heat in the direction of the fibers than in that at right angles to them. The ratio numbers, however, are somewhat different from those formerly obtained.

New Volcano in Peru.

A Peruvian newspaper, the *Bolsa*, says that extraordinary phenomena have been observed in connection with the "Corpuna" volcano in the Province of Castilla, which have caused great alarm among the population. The immense banks of snow which have crowned its summit from time immemorial have suddenly melted away with such rapidity as to cause torrents to rush down the sides of the mountain, washing out immense quantities of stones and earth. The river below, being unable to contain the great body of water so suddenly added to it, overflowed its banks, causing great damage and distress. A great chasm or lateral crater next opened on one side, throwing out volumes of smoke and steam as well as tongues of flame, which were distinctly visible at night, accompanied with loud subterranean rumblings. It had never been supposed that the Corpuna was or could be a volcano, and there is no tradition that it was ever in a state of eruption. Nor within the memory of man has its crown of snow ever been absent.

WOOD CARVER OF SIMLA.

Simla is best known as a place of refuge from the intolerable heat of the Indian plains, and as a resort where the surroundings have been Anglicized to the greatest possible extent. The natives are by no means deficient in artistic design and execution. It is in their tools, principally, that they are at a disadvantage; and the wonder is that they can do so well with such sorry appliances. There are few of us who have not had opportunities of examining and admiring Indian workmanship, whether in the case of the celebrated chains from Trichinopoly, or of chessmen, or of curious boxes made of various woods; and some of us may possess specimens of the skill with which the wood carver of Simla plies his vocation. He has, at any rate, wood enough and to spare in his neighborhood; he has the magnificent *deodar* or Himalayan cedar, the pine, the oak, and the rhododendron.

He may seem, in the picture, to set about his work in a style which would not recommend itself to the civilized wood carver; and he may appear to be handling an implement such as is used in this country for a game of ball; but he contrives, nevertheless, to turn out some good work.

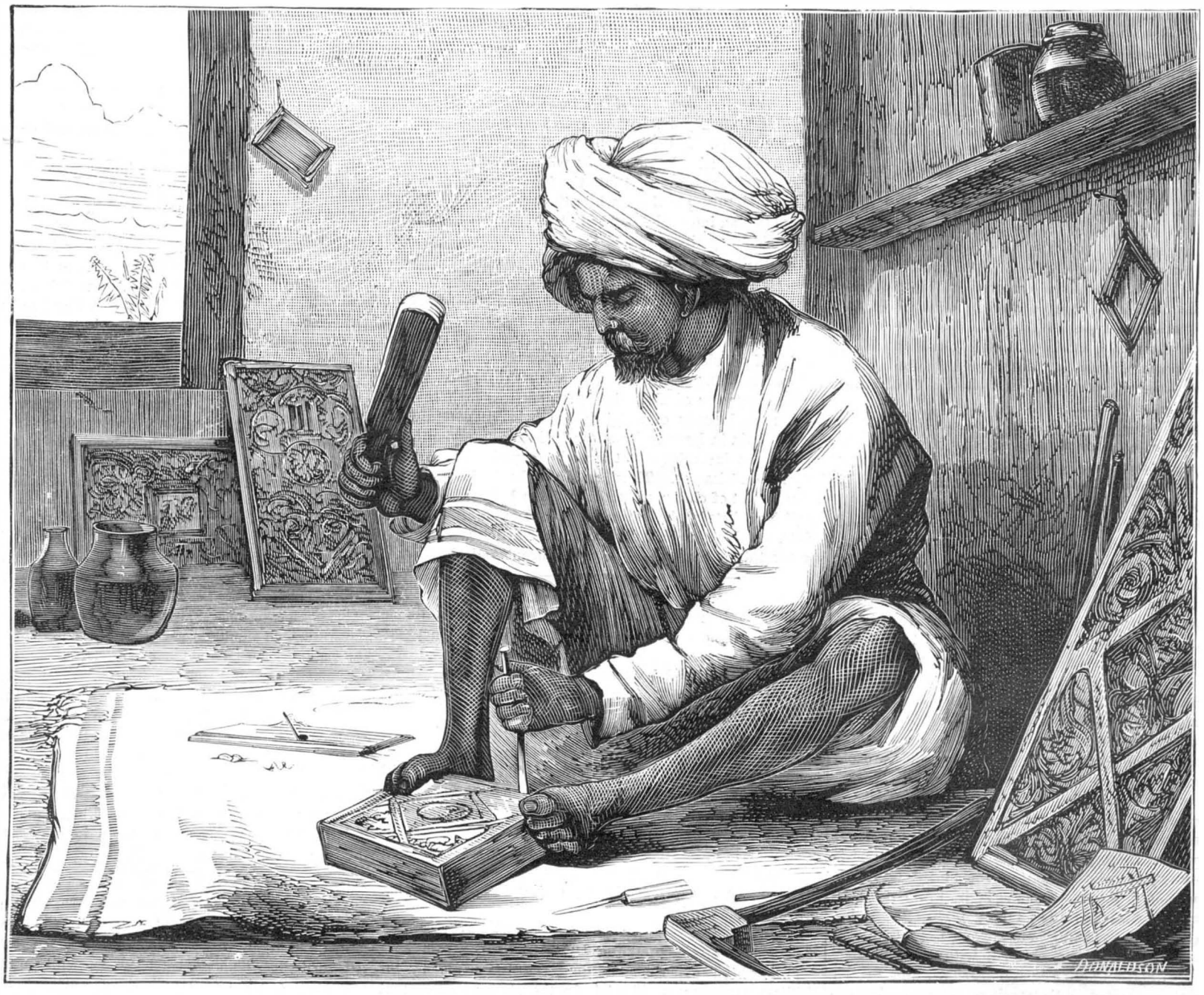
Natural History Notes.

Influence of Trees on Rainfall.—From observations made by M. Fantrat relative to the comparative influence of leafy woods and resinous woods on rain and the hygrometric state of the air, recently communicated to the Paris Academy, it appears that pine forests have a much greater influence on the hygrometric state than others; so that if the vapors dissolved in the air were apparent, like fogs, we should see forests shrouded in a large screen of moisture, and in the case of resinous woods the vapory envelope would be more distinct than in that of leafy woods. M. Fantrat also shows that pines retain in their branches more than half of the water which is poured upon them, whereas leafy trees allow 58 per cent of the precipitated water to reach the surface of the ground. He suggests, therefore, that in planting with a view to oppose inundations, it would be advisable to choose by preference resinous trees, as offering a better covert.

Nutrition of the Sundew.—Dr. Francis Darwin communicates to *Nature* the results of some experiments on the *Sundew* (*Drosera rotundifolia*) which are not without interest. A number of the plants were freely supplied with meat, while another set were kept without animal food. At the end of the season the two sets were compared in various ways with the object of deciding whether or not "Carnivorous plants" profit by an animal diet. The advantages gained by the fed plants were found to be numerous. In continuation of his experiments, he tells us that the plants on which he worked were cultivated in six soup plates, and after all the flower stems had been cut the plants in three of the plates were removed from the moss in which they grew, and were counted and weighed. The plants in the other plates were left with the object of comparing the new plants which should spring up from the winter buds of the two sets in the following year. They were then removed to the hothouse that they might rapidly send up next year's leaves. By the middle of January, 1878, it became clear that more leaves were springing up from the winter buds of the plants that had been fed than from the others. Both sets were now kept without food, and, on April 3, removed from the plates, counted, dried, and weighed. The result showed that there was only a comparatively small difference (18 per cent) between the number of not fed and fed plants. Numerous minute offsets were found among both sets and counted as separate plants. But, judging either by the total or average weights, no doubt could be entertained of the great advantage gained by the fed plants. One of the most striking facts was that in spite of the far larger yield of flower stalks, seeds, etc., produced during the previous summer by the fed plants, they were nevertheless enabled to lay by a far greater store of reserve material than their not fed competitors. The results reached by Dr. Darwin agree very well with those obtained by Drs. Kellerman and Van Raumer, who conducted a like series of experiments with the Sundew, in Germany, at about the same time.

The Cause of the Brilliant Hues of Animals.—Mr. Wallace, in his new book, "Tropical Nature, and Other Essays," just published, gives a theory to account for the diverse colors, the special adornments, and the brilliant hues which distinguish certain male birds and insects, which is quite different from that of Mr. Darwin.

The theory of the latter, it will be remembered, was that all, or almost all, the colors of the higher forms of animal life are due to voluntary or conscious sexual selection, and that diversity of color in the sexes is due at least, first of all, to the transmission of color variations either to one sex only or to both sexes, the difference depending on some unknown law and not being due to simply natural selection. Mr. Wallace regards this view as erroneous. He finds, on close examination, that neither the general influence of solar light and heat, nor the special action of variously tinted rays, is at all an adequate cause for the many wondrous complexities of color with which we are acquainted. He would therefore take another view, dividing the colors into groups, as they are protective to the creature, act as warning colors, or sexual colors, or typical colors, or simply (as in floras) attractive colors. To him the very frequent superiority of the male bird or insect in brightness of color (even when the coloration is the same in both sexes) seems to be due primarily to the greater vigor and activity and the higher vitality of the male. He reminds us that the colors of an animal usually fade during weakness or disease, while robust vigor and health add to their intensity. This intensity is most developed in the male during the breeding season. It is also very general in those cases where the male is smaller than the female. This greater intensity of color in the male would be further developed by the combats of the males for the possession of the females. Increased vigor acting thus on the epidermal system would soon produce further distribution of color, and even new tints and markings. Indeed, even the remarkable display by so many male birds of their peculiar beauties of color and plumage may be thus accounted for; for at the pairing season these birds are in a state of the greatest energy. At such a season even those birds that are not ornamental, flutter and spread their wings and erect their head-crests and tail feathers; and there would be a progressive development of these ornaments in all



WOOD CARVER OF SIMLA.

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dominant races, and if those portions of the plumage which were originally erected under the influence of anger and fear became largely developed and brightly colored, the actual display under the influence of jealousy or sexual excitement would be quite intelligible; the males would soon discover what plumes were most effective, and would endeavor to excel their rivals. It will be seen, therefore, that Mr. Wallace's theory of color might almost be called a molecular one. The causes of color are due to molecular or chemical changes of certain substances, and in the action of these on light, heat, and moisture. They can be produced or intensified by processes of development, and this as the surface bearing these colors is extended or diminished, and as there is a surplus of vital energy; or they may be, as in some plants, acted on by some as yet unknown local action dependent on the soil or on vegetation.

The Growth of Coral.—A Melbourne paper speaks of a remarkable piece of coral taken off the submarine cable near Port Darwin. It is of a common species, about 5 inches in height, 6 inches in diameter at the top, and about 2 inches at the base. It is perfectly formed, and the base bears the distinct impression of the cable and a few fibers of the coil rope used as a sheath for the telegraphic wire still adhering to it. As the cable has been laid only four years, the specimen must have grown to its present height in that time, which seems to prove that the growth of coral is much more rapid than has been supposed.

How the Lobster Annually Casts Off its Shell.—The *Zoologist* for June gives the pith of an article on this subject published by Mr. W. A. Lloyd in the *Field*, in about the following words: The lobster, feeling the time of exuviation approach, seeks a retreat where it may be safe during the period of soft helplessness, which lasts for three or four days after exuviation. This place it usually selects below some overhanging rock, and if there is a protection on each side, so much the better. If there is a good bed of sand and shingle (as there should be) six or eight inches thick, the lobster proceeds to excavate this away behind, and with its anterior limbs pushes it up in front, and makes a kind of defensive earthwork. In this operation it is aided by an occasional motion of its false feet in driving away a current of sand outward, below its tail, the head being then turned inward, toward the hinder part of the little cave thus formed, into which the lobster never allows any other creature to enter. When the moment arrives for casting the shell, the animal falls over on its side, a rupture is made in the membrane uniting the posterior of the cephalo-thorax with the anterior ring of the abdomen, and presently a part of the lobster's new coat may be seen between the two. The rent is made by the lobster suddenly and strongly bending its tail inwardly toward its head. In a few minutes the whole of the tail or abdomen is outside of the old shell, and the two may be seen side by side. Then the exuviation of the front half of the lobster goes on, all at once, legs and head-appendages and body together, and the last portions but one seen of the animal in its fresh covering are the tips of the large anterior limbs, which, as before mentioned, are for a few moments a little misshapen. Last of all appear the longer tentacles. During this whole process, which takes up about a quarter of an hour, the lower edges of the cephalo-thorax become a little separated from each other, laterally, to the extent of about one inch in a large specimen, and this appears to be for the purpose of allowing more room below than would otherwise be possible for the extrication of the limbs. As soon as the old shell is quite detached, and the animal is in its normal position, and has rested a few minutes, it pushes the cast-off shell over the edge of the earthwork of sand and shingle, outside the den, and then sometimes buries it. After solidification of the new shell, in three or four days, the shell or animal never increases till the next moult.

The Edible Pine.—This small scrubby pine (*Pinus edulis*) grows on the dry, rocky mountains of New Mexico, and is called by the Mexicans *piñon*. The seed is about the size of a kidney bean, with a rich oily kernel in a thin shell. It has a pleasant flavor, and sometimes oil is expressed from it. In favorable seasons the seeds are gathered in quantities and sold by the Indians to the people of New Mexico, Arizona, and the border settlements of Mexico. The seeds should be roasted before eaten, though sometimes they are consumed raw. The Indians of Alaska are in the habit, in the Spring, of stripping off the bark of the *Pinus contorta* (twisted-branched pine) and scraping the newly formed cambium from the trunk. This is eaten fresh or dried, pressed into compact cakes of a dark claret brown. It has a coarse look, as if made of tan bark; and, if broken up, presents a checkered appearance. When fresh it is not unpleasant, and the effect is that of a gentle laxative, but as the season advances it becomes strong in turpentine. When the cakes are old they have a bitter taste not unlike that of pine chips.

Voracity of the Blue Fish.—Mr. Carpenter, in an article on the "Fisheries of British North America," in *Nature*, states that one advantage possessed by the fishing grounds of British North America over those of the United States is their immunity from the ravages of the blue-fish—a voracious, wandering fish, whose home is in warm southern waters, its northward migration taking place only during summer, and never extending far beyond Cape Cod. Its destructive agency has had much to do with the diminished productiveness of the New England fisheries, and further south is specially exerted on the mackerel schools. According to the estimate of Fish Commissioner Professor S. F. Baird, the weight of the fish consumed by the blue-fish of the United States coast during the season is about 300,000,000,000 lbs. In its turn the blue-fish is largely consumed as an article of human food; but it is not suited for salting, and is consequently of no value as an export fish.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, July 20, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Venus rises	1 17 mo.	Saturn rises	10 21 eve.
Mars sets	8 27 eve.	Saturn in meridian	4 22 mo.
Jupiter rises	7 39 eve.	Uranus sets	8 53 eve.
Jupiter in meridian	0 30 mo.	Neptune rises	11 49 eve.

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Alpheratz rises	8 16 eve.	Regulus sets	8 51 eve.
Algol (var.) rises	9 56 eve.	Spica in meridian	5 25 eve.
7 stars (Pleiades) rises	0 20 mo.	Arcturus in meridian	6 16 eve.
Aldebaran rises	1 39 mo.	Antares in meridian	8 27 eve.
Capella rises	11 3 eve.	Vega in meridian	10 38 eve.
Rigel rises	3 46 mo.	Altair in meridian	11 50 eve.
Betelgeuse rises	3 31 mo.	Deneb in meridian	0 46 mo.
Sirius	invisible.	Fomalhaut rises	10 56 eve.
Procyon	invisible.		

REMARKS.

The sun will be totally eclipsed July 29, in the afternoon, and will be visible generally throughout the United States as a partial eclipse. The line of central eclipse—the region over which the center of the shadow passes—begins in central Asia, Lat. 55° N., Long. 165° W. of Washington, and crosses Behring Strait into Alaska at 65° N. Lat., taking a southeasterly course through British America and the United States. The total phase will be observed from various points along the route of the Union Pacific Railroad. Sherman station and Ogden have been selected as points of observation because of their great elevation, thus avoiding the denser portion of the atmosphere. By this means the distinguishing properties of instruments is increased, and consequently a much higher power can be used than would otherwise be possible and give good results. Near Denver the total occurs at 3h. 27m. P.M., local mean time, with a magnitude of 12·1 digits. The line of totality leaves the United States near Galveston, where a total phase occurs at 4h. 30m. P.M., local mean time, passing across the Gulf of Mexico and the western extremity of Cuba, giving a total phase at Havana at 5h. 34m. P.M., ending in the Carribean Sea just off the southeast shore of the island of St. Domingo, where the total occurs at sunset. At New York city the eclipse begins at 4h. 42m. P.M.; middle, 5h. 35m. P.M.; end, 6h. 28m. P.M. Size 7·8 digits upon the sun's southern limb.

Belgium, Holland, and England.

Bulgium would furnish a capital text for an essay on the advantages of a patent system. When Holland and Belgium separated, the latter was far behind in the matter of commerce; now the commerce of Belgium leads that of Holland by $50,000,000 a year, having increased thirteen fold in forty-four years. Belgium believed that it would pay to encourage invention by means of a patent law; Holland did not; the first promptly shot into the front rank of prosperous manufacturing nations, while the second is nowhere. It would be an interesting study to trace the connection of Belgium's prosperity with the 1,500 patents a year granted by that little state. That the numerous labor-saving inventions embraced by these patents have not diminished the demand there for men is evident from the single fact that Belgium is now by far the most densely populated country on the globe. Should the United States ever attain a similar density of population we should number not less than five hundred millions of people. From a recent report of the British Inspector of Factories it appears that the iron and wool manufactures of Belgium are being imported into Great Britain in large an dconstantly increasing quantities, and that the damaging effect of such competition is particularly felt in Glasgow. Thus Scotland is beginning to suffer the same sort of changes in trade as have been produced in English markets by the increasing introduction of American prints, machinery, hardware and other articles. The inspector thinks these changes "significant and alarming."

Jointed Artillery.

The jointed gun submitted for experiment by Sir William Armstrong has completed its course of firing at the proof butts in the government marshes adjoining the Royal Arsenal, Woolwich, and been handed over to the Pack Saddle Committee to arrange for its carriage by mules over mountains and across irregular country. The gun unscrews into three parts, each of which is light enough for a mule's burden, but when screwed together it forms a powerful long range cannon almost as serviceable as an ordinary field piece, and said to be perfectly gas tight at the joints. The light 7-pounders which constituted the artillery of the Abyssinian campaign and the expedition to Coomassie have, with a few small howitzers, been the only guns of the mountain train; but the invention of Sir William Armstrong is regarded as having opened a way for greatly augmenting the power of that branch of the service.

The Armstrong 100-Ton Gun.

The 100-ton experimental gun, the first made by Sir William Armstrong at Elswick for the Italian Government and proved at Spezzia, is said to have cracked its inner tube. This is a possibility not unlooked for in the case of an experimental gun, and it may be recollected that a similar mishap occurred both to the first of the 80-ton guns and the experimental 35-ton gun, the original "Woolwich Infant." Both these guns have been retubed and rendered serviceable.

THE PHONOGRAPH.

Although the phonograph is expensive, and difficult to construct in its most perfect form, it is nevertheless capable of being made on a cheaper scale, so as to afford a world of amusement for both young and old.

The materials for a phonograph which will talk, whistle and sing, and which may be used by our experimenters in developing any new ideas concerning it, may be purchased for $1.50, and full directions and complete scale drawings which will enable any one to make the instrument may be found in the current number (No. 133) of the SCIENTIFIC AMERICAN SUPPLEMENT.

Scientific American Boat Drawings.

The San Francisco *Chronicle* gives an instructive account of the pluck and perseverance of two young men of that city. During their off hours, and often by the light of a lantern at night, these lads have built a 33 foot jib and mainsail yacht with no other instruction than the directions and drawings published in the SCIENTIFIC AMERICAN SUPPLEMENT of April 14, 1877. "It seems incredible," says the *Chronicle*, "that two young men, scarcely more than lads, unaccustomed to the use of tools, should have succeeded in constructing a seaworthy vessel from drawings;" but it is no greater feat than many others may do by consulting the full and practical instructions for building large and small sail and row boats and steam launches, published in many numbers of the SCIENTIFIC AMERICAN SUPPLEMENT.

Wire Tramway Worked by Water Wheels.

The tramway connecting the town of Lausanne with its harbor Ouchy, on the lake of Geneva, consists of two lines of rail, and two trains which are connected by a wire rope. At the top of the tramway the rope passes over a winding drum, through which the trains are put in motion. The two trains keep each other in equilibrium, the one ascending upon one line while the other descends on the other line, and *vice versa*.

The tramway is 1,650 yards long, and leads in a straight line from Ouchy up to Lausanne, passing on the way a tunnel several hundred yards in length. The steepest gradient is 1 in 9.

The winding drum is driven by two Girard turbines, which work under a head of 393 feet; they are made of brass on account of the high velocity of the water, due to the great head; they have a diameter of 7 feet 4 inches, and run at a speed of 170 revolutions per minute. The water can easily be turned on and off the turbines by means of circular slides worked by hydraulic gear.

The two turbines are fixed upon a horizontal shaft, which carries also a brake wheel, the band of which is worked by gears similar to the slides, and spur gear for transmitting the motion to the winding drum.

The winding drum is 19 feet 8 inches in diameter and 13 feet long, and is covered with wood lagging. As it has to transmit by mere friction a force of 180 H. P., making at the same time only a few revolutions per minute, the following arrangement to produce the necessary friction has been contrived by M. Callon, the designer of the tramway: The winding drum is placed in a position parallel to the direction of the tramway and considerably lower than the level of the rails; the rope is wound on the drum in two coils, and above the drum; the two ends of the rope are made to pass over two guide pulleys, which stand at right angles to the drum, and are carried in sliding bearings. By means of bevel gear and screw spindles, these pulleys are made to move to and fro along the winding drum, thus forcing the rope to travel continually from one end of the drum to the other, and preventing the surface of the latter from being worn smooth, as it would be if the coil were always on the same spot.

Shell Polishing.

The Royal Laboratory Department in the Royal Arsenal, Woolwich, have practically abolished the operation of giving a smooth surface to shot and shell by the use of the lathe. The method of casting these projectiles of exact size and smooth exterior was first carried out on account of the expense which would be saved by the abolition of turning, but a still greater advantage has been found in the superior hardness of the unturned shells, the one tenth of an inch of the outer skin which it has been usual to turn off the Palliser projectiles being equal in strength to one third of the interior surface. By reducing the thickness of the walls the shell is thus enabled to contain a much larger bursting charge without any diminution of penetrative power, and the whole mass proves to be more cohesive and serviceable in what may be regarded as its natural skin than after the material and chemical changes wrought in its constitution by the friction of the lathe.

FLOATING BATTERIES AT KERTCH.—Two powerful floating batteries have been launched by the Russians, at Kertch. Each battery is constructed of several boats fastened together and fitted with a large number of watertight compartments, to which are attached powerful pumps. Their armament consists of 9 inch rifled guns. Four of these floating batteries are now connected with the defenses of Kertch, and others are under course of construction.

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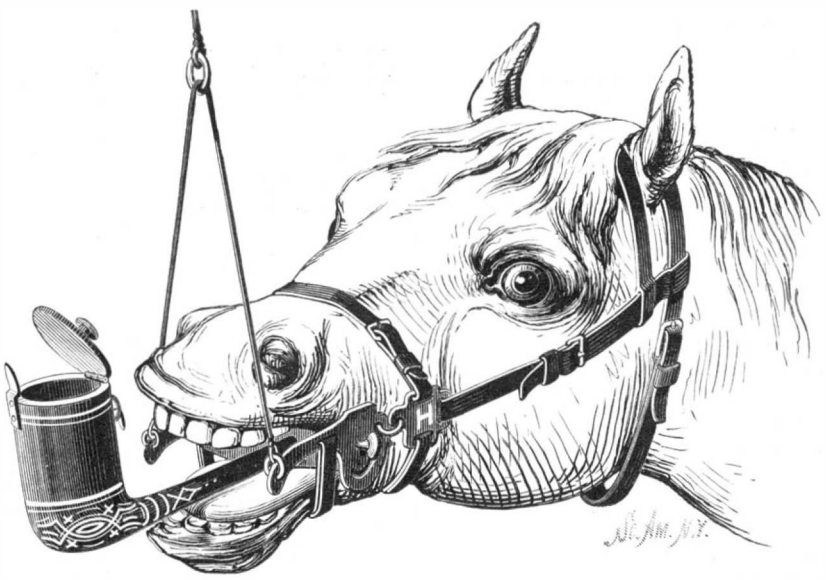
APPARATUS FOR ADMINISTERING MEDICINE TO HORSES.

As it is generally useless to attempt to persuade a horse to take medicine voluntarily, owing to his equine inability to appreciate its advantages, combined with dislike for the taste, mechanical means are sometimes resorted to, and an ingenious contrivance for the purpose is represented in the accompanying engraving. It consists of a wooden gag bit, which is placed in the horse's mouth and suitably attached to the headstall. By pulling the cord shown, the gag is turned by levers, compelling the animal to open its mouth. The stem of the medicine receptacle, which looks like an exaggerated tobacco pipe, is then inserted in a hole in the bit and clamped therein. Then, by opening a valve in the receptacle, the medicine previously placed in the bowl runs down the horse's throat. Also in the stem is a kind of fork, which, when a pill is to be administered, holds the same until it is washed down by water poured into the bowl.

This device was patented through the Scientific American Patent Agency, February 26, 1878, by Mr. Henry Hartman, of Camp Halleck, Elko county, Nevada.



APPARATUS FOR ADMINISTERING MEDICINE TO HORSES.

Apprentice Shops for the Boys.

The necessity for more skilled labor is urgent upon the people of the United States, while at the same time the number of young men or boys who need the rudiments of practical pursuits is very large, especially in every considerable town in the country. To meet this want the establishment of shops for the production of numberless smaller articles is practical, and where the work should be chiefly done by boys without further compensation or expense attending their teaching and labor than that they shall receive an amount of instruction in the rudiments of knowledge, especially in the natural sciences and the knowledge pertaining to the practice of the trade they select to learn, and that they be apprenticed for a certain length of time without compensation, and for a compensation for a length of time afterward.

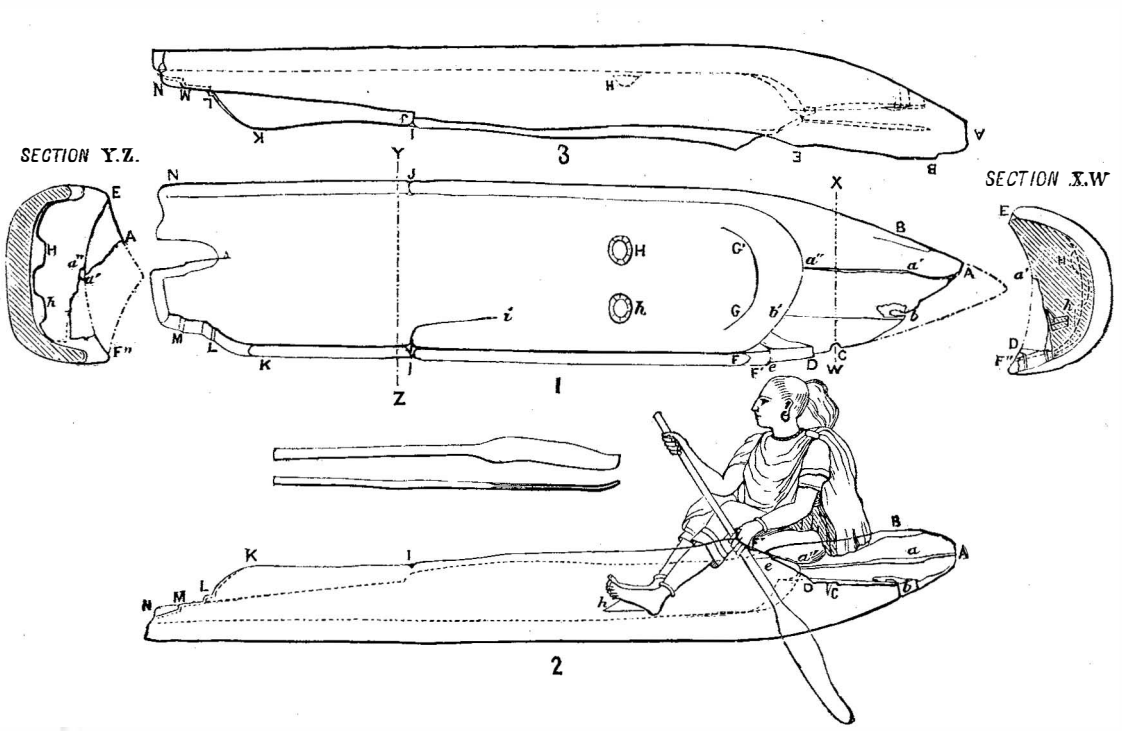
The shops in healthy locations and the confinement of the younger classes not greater than in schools; shops of this character fitted for woodworking by hand and by machinery, wood turning, carving, and moulding, and ornamental as well as useful, also for founding and fitting articles in cast, malleable, and wrought iron and steel, for metal working and the manufacture of useful and ornamental articles—these are especially practical, and with their establishment and the experience gained other shops would be from time to time established.

Why not a master workman be furnished with the small beginnings of a shop and take pupils to teach in special branches, as well as now teaching telegraphy, music, drawing, bookkeeping, or any of the special callings?

A BOAT OLDER THAN THE ARK.

During November last an association of boatmen, calling themselves Lacustrians, on account of their trade, being the exploration of the shoals of Lake Geneva in search of antiquities buried in the bottom, discovered in the lake, and near the town of Morges, the remains of a large ancient dug-out. The boat was buried in about fifteen feet of earth, and during its exhumation, owing to the great fragility of the old wood, it was broken in several places. It was finally transported to the museum at Geneva, and there rests submerged in water to prevent the corrosive action of the atmosphere. We take from *La Nature* the annexed engraving, exhibiting the construction of the oldest known vessel, the period of the making of which far outdates that commonly ascribed to the construction of Noah's Ark.

Fig. 1 is a plan, and Figs. 2 and 3 lateral elevations. The two smaller illustrations exhibit sections. It is probable that the two extremities terminated in points, but one end is badly ruptured, and the pieces could not be found. The length is about 15 feet, breadth 27 inches, and thickness of sides and bottom from 2 to 4 inches. The end, A E F F', is not dug out, and is rounded to form a seat. Near this and on the bottom are two projections, H *h*, evidently intended as stretchers for the occupant of the boat to brace his feet against while paddling. It is probable that the boatman, therefore, seated himself as shown in Fig. 1, facing the bow and using his paddle exactly as do the Indians of the present day in the propulsion of their canoes. The boat was hewn from the trunk of an oak, evidently with implements of stone or bronze.



A BOAT OLDER THAN THE ARK.

New Agricultural Inventions.

Mr. Reuben O. Kinne, of Eldorado, Ill., has patented a new Grain Binding Attachment for reapers, which is so constructed as to bind the grain with straw bands. The construction is very ingenious, embodying ten new mechanical devices.

Mr. B. T. Timby, of Ridgeway, N. Y., has patented an improved Composition for invigorating trees and protecting them from insects and improving the fruit.

Mr. David Wolf, of Avon, Pa., has invented an improved Plow Point, which is reversible and invertible, and in other respects of novel construction.

The improved Harvester patented by Mr. William Gangwer, of Mulberry, Md., Nov. 14, 1876, has been improved by him so as to simplify the construction, and so that the gavels may be dropped to the ground out of the way of the machine on its next round.

An improved Grain Separator has been patented by Messrs. William M. Redd and Erastus M. Sandford, in which the new feature is a cover suspended over the screen to hold the grains flat on the latter.

Mr. Orson J. Smith, of Farmer City, Ill., has patented a new Watering Trough, which has a detachable cover, or protector, having an inclined roof in which are formed openings to permit the stock to have access to the water, and to which boards are hinged for use in closing said openings when required.

A new Garden Hoe has been patented by Mr. Calvin W. Polen, of Hazel Dell, Ill., which is suitable for cultivating young plants in drills, and which may be adjusted to suit different distances between the rows, and to throw the soil to or from the plants.

Mr. Rease W. Workman, of Rock Hill, York Co., S. C., has patented a new Plow. The invention consists in attaching a semicircular plate to the underside of the beam, in a vertical position, and in such relation to the standard that it will brace the latter at the same time it performs the function of a colter. The invention further consists in attaching the lower ends of the handles to the colter plate so that they brace the latter against lateral strain.

Mr. David S. Thomas, of Powell, Delaware Co., Ohio, has patented a new Bee Hive, in which are means for narrowing or closing the bee entrance; for enabling the hive to be conveniently used for two colonies of bees at the same time; and for holding the frames the proper distance apart.

Employment of Ships against Forts.

Admiral R. V. Hamilton, C.B., in a recent lecture before the United Service Institution, London, placed before his audience some very carefully collated and elaborate facts regarding the important work performed by the American navy during the Civil War in America, his purpose being to draw lessons for our own navy as to work which may have to be performed with ships and armaments "as yet almost untried in actual warfare." At the commencement of his lecture, Admiral Hamilton pointed out that owing to the exigencies and peculiar nature of the American Civil War, a very large portion of the naval work was done by ships and guns invented or adapted to meet novel modes of warfare, and he had no hesitation in saying that it was their naval superiority in the commencement which enabled the Northerners to penetrate the various rivers, creeks, and bayous in the heart of the Southern Confederacy. The navy, too, in several instances decided the fate of battles by the protection afforded by the fire to the wing of the Northern army resting on a river, as at Pittsburg, Lanburg, and Vicksburg, and the escape of Morgan's expedition in Indiana and Ohio across the river into Kentucky was prevented by a gunboat, which arrived at different fords in time to stop his men crossing. On the navy, in a great measure, also depended the supplies and transport of the army, but as these services were not as showy and interesting as the numerous battles between the conflicting armies, they were but little known or appreciated by the general public—a complaint, he need scarcely say, not peculiar to the American navy.

The lecturer described the positions on both sides on the commencement of the war, April, 1861, pointing out that the North held the ships, 42 in number, which then composed the American navy, a number which was increased by the following December to 264, and a year afterward to 427, while in 1864 the number was increased to 671. He dwelt upon the energy shown by both sides to obtain what was required, and from these facts he drew the moral—"That with the number of eminent firms we have in this country skilled in iron and ironclad shipbuilding our government have only to make up their minds what course they intend adopting in regard to attacking forts and other services of any nation we may be at war with, and be prepared to rapidly run up, as the Northerners did, light draught ironclads, adapted for the special work."

At great length he described, with the aid of charts and plans, the work performed by Commodore Stringham with ships against the forts at Hatteras Inlet, commanding the main entrance into Pimlico Sound, where with seven wooden ships carrying 158 guns, 70 on a broadside, the forts were rendered untenable. The work was done by the ships passing and repassing the forts and pouring in a continuous shower of shell and shot, and as the ships did not give the forts the range by anchoring, the firing from the forts was wild and irregular. Admiral Hamilton held that the successful result in this case was owing to the superiority of the shell firing against earthworks, for little damage would have been done to these works by solid shot.

Admiral Farragut's expedition against New Orleans was then spoken of, and described as the boldest and most successful effort ever made to match wooden ships against forts at close range, the forts, too, being assisted by ironclad rams and a fleet almost as numerous as the attacking fleet. The attack on Vicksburg, the action of the Upper Mississippi squadron, and other work by the Northerners against forts and ships were described by the lecturer in detail, and he drew attention to the immense superiority given to the North by her possession and use of shells. The conclusions he drew were: Shell must be the rule against forts and unarmored vessels, solid shot the exception — shell demoralizes where it does not penetrate. In attacking forts under way, very close order must be kept. Farragut passing Vicksburg remarks: "If the ships had kept in close order, in all probabilty they would have suffered less, as the fire of the whole fleet would have kept the enemy from his guns a longer space of time, and when at his guns his fire would have been more distracted." If hydrography permit, pass and repass the forts at various distances previously arranged, by which your own time-fuses can be fitted, while the enemy will have difficulty in getting your range; ships not to follow in each other's wake. A powerful ironclad navy with numerous vessels of light draught ought in time to capture forts isolated from the main land and unable to get in fresh troops. Water defenses with an army in rear

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can only be taken by a combined army and navy attack. A good corps of surveyors is essential. In all coast defenses against ships, naval officers should be consulted on the position of the fort.

In the discussion which followed, Captain Colomb, R.N., supported the tactics of ships passing and repassing the forts they are attacking, and pouring in broadside after broadside. This caused loss of nervous power in the garrison. Captain Burney insisted upon the necessity of commanders of ironclads maneuvering their ships at full speed in time of peace, so as to become perfectly acquainted with the peculiarities of their ships. Mr. Scott Russell, Admiral Selwyn, Commander Curtis, General Cavanagh, and Captain M'Intye, R. N., also spoke.

New Inventions.

A new Tray Lifter for trunks, patented by Mr. A. A. Vola, of Brooklyn, N. Y., consists of a catch which is applied to the trunk lid and is capable of engaging a tray to lift the latter when the lid is raised.

A new Skirt, invented by Mr. Samuel Fellner, of Streator, Ill., has an upper flannel portion combined with lower portions of rubber cloth and interposed cotton wadding. It does not absorb dampness, and when soiled can be easily cleansed with a sponge.

A new Sleeve Button Link, devised by Mr. Charles Hein, of Corona, N. Y., consists in a double hook and locking bar, pivoted to each other at the center of the link in such a way that the ends of the said bar may be sprung into grooves in the said hooks.

An improved Shoe, devised by Mr. William G. Viall, of North Adams, Mass., has its upper made in two pieces, the vamps being cut in one piece with the tongue, and with rearwardly projecting points, and the quarters being cut in one piece, with deep side slits to receive the points of the vamps.

A new Piston Rod Packing, patented by Mr. William Cram, of Raleigh, N. C., consists of a cut ring and a pressure ring so arranged as to form a chamber to receive a lubricant filling which may bear against the trunk.

A new Dental Plugger, devised by Julius M. Stebbins, D.D.S., has a mallet which reciprocates in a tubular chamber from the alternate compression and suction of the air in the rear of the same, so as to cause the said mallet to deliver a series of blows upon the anvil of the tool holder.

An improved Game Apparatus for playing a game analogous to bagatelle, called "bassino," has been invented by Mr. James M. Stewart, of Franklin, Mass. The game is an interesting one, and is likely to become popular.

A new Purse has been devised by Mr. August Vogel, of New York city, which is woven throughout on a loom with a longitudinal center slit or opening, and with transverse closing end bars. It may be divided into sections or pockets.

An improved Faucet Hole Attachment to Barrels has been patented by Mr. E. T. Murphy, of Cambridgeport, Mass. It may be applied permanently to the barrel head and operated by the inserting or taking out of the faucet, that operates a spring acted slide tube of the faucet hole bushing.

An improved Wood Sole Shoe has been patented by Mr. William Gampert, of Keokuk, Iowa, which is strong and durable, and the sole of which may be applied to boots and shoes of any kind.

A new Ticket Case has been patented by Mr. Lewis E. Heaton, of Providence, R. I., which is a convenient receptacle for carrying cards or tickets, and which is so made that but one ticket can be removed at a time.

An improved Saddle Tree Fork has been devised by Messrs. C. M. Lane and M. C. Franklin, of Lockhart, Tex., which is formed of a cast malleable iron fork, a detachable wooden pommel, and wooden side pieces.

A new Spring Bottom for Vehicles has been devised by Mr. E. D. Cramer, of Hackettstown, N. J., which may spring up and down with the body without getting out of place, and which allows the body to be placed lower upon the axles than is usually possible.

Mr. Stephen Sibbald, of Nelsonville, Ohio, has patented a new heater, whereby one or more rooms may be supplied with a continuous current of heated air from one fireplace, at a considerable saving of fuel.

A new Barrel Top Show Case has been patented by Mr. W. H. Grubb, of Hannibal, Mo. It is so constructed as to exhibit merchandise generally sold in barrels, and to obviate the necessity of frequently opening the latter in order to examine the goods.

A new Fire Escape, consisting of an arrangement of wires, a flanged reel and belt for the person being lowered, has been patented by Mr. Francis G. Bryant, of Seattle, Washington Territory. It seems to be an ingenious and efficient device.

A new Chair Back, consisting of thin elastic strips arranged with their ends in grooves of frame, and connected by a corresponding V-shaped convexity and concavity of their adjacent edges, has been invented by Messrs. W. H. S. Greene and A. Sturdevant, of Summit Station, N. Y.

A new Desk, which may be attached to walls and which also may serve as a flower shelf, work table, or side table, has been patented by Messrs. George and John Runton, of Hoboken, N. J.

An improved Child's Carriage, so constructed that its body is rocked when the carriage is moved in either direction, has been patented by Mr. H. Borchardt, of Philadelphia, Pa.

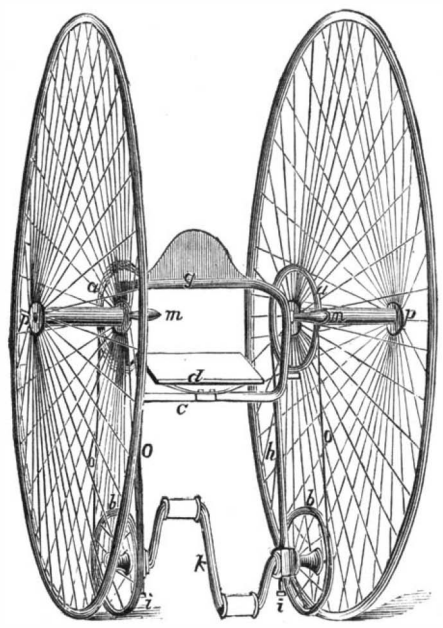
Mr. William Hill, of Sennett, N. Y., has patented a new Clothes Wringer, so constructed that the gear wheels will remain in mesh however much the pressure rollers may be forced apart, that they may be adjusted to give increased leverage, and that the rollers will be pressed together only when the wringers are attached to their supports.

An improved Horse Collar has been patented by Mr. Martin F. Sauer, of Somonauk, Ill., in which the cover of the rim is a single piece of leather. The cover of each belly is also a single piece of leather, having slits formed in the outer edge. The strips and also the belly and rim covers are held together by rivets.

Albert K. Hawkes, of Austin, Texas, has patented an improvement in Eye Glasses, in which the spring that connects the two lenses is made in two parts, which are connected so as to admit of adjustment for the purpose of shortening or lengthening the spring, and thereby correspondingly increasing or diminishing its strength, for the purpose of causing it to press on the sides of the nose of the wearer with greater or less force. The glasses can thus be adapted to different sized noses and worn with greater comfort.

THE OTTO BICYCLE.

This is a new style of bicycle lately brought out in London. Its lightness and simplicity of construction are said to

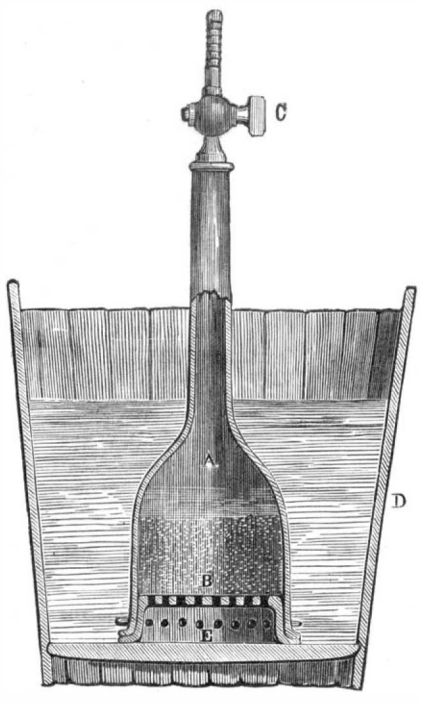


make it one of the safest and easiest going bicycles. The steering is effected by a very simple contrivance, which does not cause any effort to the rider.

C is a bent steel axle, on which rests the rider's seat; on the ends of this axle are two large wheels, which can move independently of each other. To these wheels are attached pulleys, *a a*, which correspond in size with the two pulleys, *b b*, on the treadle crank axle, K. This latter turns in two sliding axle boxes contained in the ends of the steel rods, *h h*, which are attached to the axle, *e*, and the back of the rider's seat, *g*; *o o* are the gut bands that connect the pulleys; *m m* are the handles of the steering gear, which regulate the revolution of the wheels, or stop them entirely by loosening the gut bands and putting on the brakes.

A SIMPLE GAS GENERATOR.

The device illustrated herewith is a handy contrivance for facilitating the manufacture of any gas capable of being pro-



duced by liquid reactions and on a small scale. It consists of a bottle shaped tinned copper vessel having at its bottom a grate, B. In the receiver, A, is placed the solid material, which for the production of hydrogen would be iron filings or zinc. The acidulated water is contained in the vessel, D. On opening the cock, C, the water penetrates at E, passes through the grate openings and acts on the metal filings. Hydrogen is then disengaged and fills the upper tube, escaping at the outlet above. When it is desired to check the production of the gas the cock is closed and the pressure drives the water out of the receptacle, A, leaving the metal filings dry. We are indebted to *La Nature* for our engraving.

Labor in Scotland.

The Consul at Dundee sends schedules of wages and prices of food for the last five years. Wages have increased in that time from 5 to 15 per cent; 51 hours make a week's work in the building trades. Bricklayers and plasterers now receive 20 cents an hour; plumbers, masons, and slaters, 16 to 17 cents; painters and carpenters, 15 cents; and common laborers on building work, 12 or 13 cents. Stonecutters are paid 24 cents. The weekly pay ranges from $6.12 to $12.24. Engine and machine working artisans receive from $4 to $8 weekly, while the various manufacturing tradesmen get from $3.50 to $8.50, according to trade and skill. Women get from $2 to $3.25 for a week's work of 51 hours. Railway engineers and passenger and freight train hands are paid from $8.50 to $10 per week of 60 hours; stokers from $5.75 to $6.25, and porters from $4 to $4.50. The industry of Dundee is mainly the manufacture of jute. The men are paid from $1.50 to $7.50, the women from $3 to $4.25 per week of 56 hours. Bread costs 15 cents for a four pound loaf; flour and oatmeal, 4 cents a pound; milk, 8 cents a quart; potatoes, 38 cents for 28 pounds; meat, 16 to 24 cents a pound; eggs, 30 cents a dozen; and other articles in proportion. A suit of serviceable Scotch tweed costs $17. The rent of a two-roomed house is $48 yearly; of a three-roomed house, $72; of a four-roomed house. $95; and so on. The trade of the district is in a most depressed condition, and the jute mills have ceased to be profitable.

The Cattle Drives of 1878.

A correspondent of the *Times*, writing from Dodge City, Kansas, the great shipping point for cattle, reports that the cattle drives from Texas this season will foot up from 225,000 to 250,000 head; some say 300,000. A large share of these will be driven from Dodge City up the Arkansas and Purgatoire, or into the parks, or over the divide into the Platte Valley. Others will go to the ranges on the Republican. During the past three or four years very many Texan cattle have thus been scattered over the plains to multiply. By the introduction of the best blooded stock the quality of the increase on the plains has been greatly improved, so that plains fed beeves are now getting the best prices in Eastern markets. The cattle interests of the plains and the Rocky Mountain region are also receiving large accessions from the far West. An Oregon paper reports that 100,000 head of cattle from eastern Oregon and Washington Territory, and from Walla-Walla and the Yakima and Snake River countries, are ready for driving across the continent, some to be held back on the plains of Colorado, Wyoming, and Nebraska for good marketing, others to be driven direct to Omaha. Within a few years a great change has taken place in the cattle trade, and more is promised in the immediate future. The feeding grounds are being transferred from Texas to the great buffalo plains; and the central portion of the continent, with the Pacific States, are becoming the leading producers of beef. An estimate derived from the assessment returns of this year gives Colorado 550,000 head; Wyoming, 225,000; Utah, 350,000; Washington, 200,000; Montana, 300,000; Oregon, 175,000; California, 650,000. Though Texas has probably twice as many cattle as all these together, the indications are that the great West will soon take and keep the lead.

Effects of Emancipation.

Revisiting the scenes of his war experience, Col. Higginson finds a marked improvement in the social and physical condition of the blacks. The negroes now sleep in beds where formerly they slept on the floor. The cabins, in old time, had no tables, and families rarely ate together, but now they generally have family meals. Pictures from illustrated papers adorn the walls, and the children's school books are seen on the shelf. Col. Higginson met but one of his black command who complained of poverty, and he earned good wages, but having no wife or children to support, was given to whisky. Most of his old soldiers had a comfortable homestead, with from five to two hundred acres of land. Many were highly prosperous.

A New Trouble with French Wines.

M. Gautier has lately brought to the notice of the French Academy of Sciences a disorder affecting the wines of the southern part of France, hitherto undescribed. This trouble, which is known as *vins tournés*, appears after warm and rainy seasons. The wine becomes troubled, and its surface irisated; the coloring matter passes from red to violet-blue, and is precipitated, the supernatant liquor being yellowish-brown, and having a baked odor and an acid and slightly bitter taste. M. Gautier states that these changes are brought about by a parasite which appears in a filamentous form in the deposit.

American Institute Exhibition.

The forty-seventh exhibition of the American Institute, New York city, promises to be of unusual value. Our inventors and manufacturers have at last learned the value of meeting the purchaser and consumer face to face. For rules, space, etc., address the General Superintendent.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Church Pipe Organs, new and second-hand, ready for delivery. Send for particulars. Henry Erben & Co., Organ Builders, East 23d St. near 2d Ave., New York.

Portable and Stationary Engines; Boilers of all kinds; 45 Cortlandt St., N. Y. Erie City Iron Works, Erie, Pa.

For best Cylinder Oil, R. J. Chard, New York.

Alcott's Turbine received the Centennial Medal.

Assays of Ores, Analyses of Minerals, Waters, Commercial Articles, etc. Technical formulæ and processes. Laboratory, 33 Park Row, N. Y. Fuller & Stillman.

Kreider, Campbell & Co., 1080 Germantown Ave., Phila., Pa., contractors for mills for all kinds of grinding.

The only Engine in the market attached to boiler having cold bearings. F.F. & A.B. Landis, Lancaster, Pa.

The Chemical Laboratory of Rutgers College will be open from July 5 to September 5, for special courses in analytical chemistry, mineralogy, and experimental chemical investigation. For terms, etc., address Prof. P. T. Austen, Ph.D., F.C.S., Lock Box 2, New Brunswick, N. J.

For first rate Hand, Foot, or Steam Band Saws, price $35.00, address G. W. Baker, Wilmington, Del.

Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

Pulverizing Mills for all hard substance and grinding purposes. Walker Bros. & Co., 23d and Wood St., Phila.

Best Steam Pipe & Boiler Covering. P. Carey, Dayton, O.

Sperm Oil, Pure. Wm. F. Nye, New Bedford, Mass.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Diamond Engineer, J. Dickinson, 64 Nassau St., N.Y.

Foot Lathes, Fret Saws, 6c., 90pp. E. Brown, Lowell, Ms.

Boilers & Engines cheap. Lovegrove & Co., Phila., Pa.

Punching Presses, Drop Hammers, and Dies for working Metals, etc. The Stiles & Parker Press Co., Middletown, Conn.

"The Best Mill in the World," for White Lead, Dry, Paste, or Mixed Paint, Printing Ink, Chocolate, Paris White, Shoe Blacking, etc., Flour, Meal, Feed, Drugs, Cork, etc. Charles Ross, Jr., Williamsburgh, N. Y.

North's Lathe Dog. 347 N. 4th St., Philadelphia, Pa.

Safety Linen Hose and Rubber Hose, all sizes, at reduced rates. Greene, Tweed & Co., 18 Park Place, N. Y.

Dead Pulleys, that stop the running of Loose Pulleys and Belts, taking the strain from Line Shaft when Machine is not in use. Taper Sleeve Pulley Works, Erie, Pa.

Improved Wood-working Machinery made by Walker Bros., 73 and 75 Laurel St., Philadelphia, Pa.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

For Heavy Punches, Shears, Boiler Shop Rolls, Radial Drills, etc., send to Hilles & Jones, Wilmington, Del.

2d hand Planers, 7′ x 30″, $300; 6′ x 24″, $225; 5′ x 24″, $200; sc. cutt. b'k g'd Lathe, 9′ x 28″, $300; A.C. Stebbins, Worcester, Mass.

Best Turbine Water Wheel, Alcott's, Mt. Holly, N. J.

Patent Wood-working Machinery, Band Saws, Scroll Saws, Friezers, etc. Cordesman, Egan & Co., Cincin'ti, O.

Band Saws, $100; Scroll Saws, $75; Planers, $150; Universal Wood Workers and Hand Planers, $150, and upwards. Bentel, Margedant & Co, Hamilton, Ohio.

The only genuine Geiser Self-regulating Grain Separator. Address the Geiser Manuf. Co., Waynesboro' Franklin Co., Pa.

Diamond Self Clamp Paper Cutter; Howard's Parallel Vise. Howard Iron Works, Buffalo, N. Y.

Empire Gum Core Packing, Soap Stone Packing, in quantities to suit. Greene, Tweed & Co., 18 Park Place, N. Y.

The key to $80,000 for $250. T. J. Duncan, Towash, Texas.

J. C. Hoadley, Consulting Engineer and Mechanical and Scientific Expert, Lawrence, Mass.

Valuable Invention to users of Steam Boilers. See advt., page 318, May 18, '78. Address U. S. Automatic Stoker Co., No. 2 Chestnut St., Philadelphia, Pa.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

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Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburgh Steel Casting Company, Pittsburgh, Pa.

Presses, Dies, and Tools for working Sheet Metals, etc. Fruit and other Can Tools. Bliss & Williams, Brooklyn, N. Y., and Paris Exposition, 1878.

For Power & Economy, Alcott's Turbine, Mt. Holly, N.J.

Notes & Queries

(1) M. M. B. asks: What is meant by 500 diameters when applied to the power of a microscope? Does it mean that an object is magnified five hundred times, or that it appears five hundred times larger than with the unaided eye? A. Linear magnification is meant when so many diameters are spoken of. Superficial magnification equals the square of the linear magnification; for instance, the former will be 250,000 when the latter is 500.

(2) T. W. F. writes: I wish a recipe for the destruction of liceeggs on hogs, without injury to the skin; or some solution that will drive them away. A. Rub along the spine and inside the thighs a mixture composed of 4 ozs. of lard, one tablespoonful of sulphur, and one tablespoonful of kerosene oil.

(3) A. S. B.—The insect is what is commonly called the carpel beetle. Le Conte, who received the first specimens from Oregon, referred it to *Anthrenus lepidus*. Dr. Lintner points out that they conform in many respects to *A. scrophulariæ*, and examples reared by Mr. Fuller from larvæ taken in New York city were clearly identical with the last named. It is a difficult pest to dislodge; cotton moistened with benzine, or preferably kerosene, and forced into the cracks of the floor, under the surbase, etc., according to Lintner have thus far proved the most effectual means of destroying them and preventing new innovations. The ordinary applications of camphors, pepper, tobacco, turpentine, etc., are powerless against it.

(4) P. H. L. asks for a recipe for a cement for mending rubber goods. A. Caoutchouc, 1 part; benzole, 5 parts; digest with occasional stirring until solution of the gum is effected. Or fuse together equal parts of pitch and gutta percha, and to this add about 2 parts of linseed oil containing 5 per cent of litharge; continue the heat until the ingredients are uniformly commingled. This is applied warm to the fabric.

(5) J. S. O. asks: How can I mix a paste or what ingredients are best to use to fasten wall paper and border so that when we glue-size and varnish on them the edges will not curl up and draw off? We have tried flour and starch paste, and also used glue in small quantities, but have had the same trouble in each case. A. In place of water alone try a strong solution of shellac 4 parts, and borax 1 part, in boiling water; cool and add wheat or, better, starch flour to proper consistency.

(6) H. H. asks how to tin strap iron, that is, put a tin coating on so it will not rust. A. Clean the iron by submitting it to a bath of 1 part oil of vitriol and 30 parts water, and scouring with sand if necessary; dry it in warm sawdust, and then pass it through a bath of molten tin covered with tallow or rosin oil.

(7) A. O. D. asks: 1. How can I temper steel the hardest, such as scrapers and small pieces of steel? A. You will find full instructions in Joshua Rose's papers on "Practical Mechanism," that have been published in the SCIENTIFIC AMERICAN. 2. What rule is used to calculate the horse power of a compound engine? A. Multiply the mean effective pressure in pounds per square inch in each cylinder (to be ascertained by the application of the indicator) by the area of each piston in square inches, respectively; multiply each of the above products by the piston speed in feet per minute in the cylinder to which it refers, add the two products, and divide by 33,000.

(8) W. C. E. asks: Can water be raised 24 feet high with a steam siphon with as much economy as with a steam pump? A. We think there is but little difference, in general.

(9) J. T. asks: What is cat silver used for? Is it used for anything in this country? Webster says it is a "mineral, a variety of mica." If it is good mica, what is it worth? Would a mine of it pay to work? Is it not used in the atove business? A. The name was once applied to the small scales of mica (the glimmer of the Germans) forming the sand derived from a yellowish mica schist. It has been used in paints or varnishes, sealing-wax, bronze powders, and with sizing in decorative art. Large pieces of clear mica (Muscovite)—from 2 to 15 inches—are of commercial value. See article on the "Utilization of Mica," p. 241, vol. 34, SCIENTIFIC AMERICAN.

What is a good article of stillingia worth in New York city? A. The extract is sold at $1 per lb.

(10) A. P. writes: I am running a stationary engine 14 x 36, with two 2-flue boilers 24 feet long, 42 inches diameter, 12 inch flues, which have been in actual use 28 years, and for the last four years been under pressure night and day, and never had but one patch on them in all this time. I tested them at 100 lbs. 4 weeks ago, and they stood it well. Can this number of years be beat? Please answer and let me know. I carry an average pressure of 60 lbs. to the square inch. A. This is an excellent record, speaking well both for the boiler maker and the engineer. We would be glad to hear from any one who can make as good a showing.

(11) W. W. writes: I am running a mill which stands 140 yards from a creek. The bottom of creek is 33 feet below mill; the well at mill is 37 feet deep; by raising dam 4 or 5 feet, which will give me 8 feet fall in the well, can I run a siphon? A. Yes, but to no particular advantage, as we understand the situation. However, if you will send a sketch, with dimensions, showing proposed arrangement, we shall be better able to judge.

(12) A. B. P. asks: How can I make potassiumsulphocyanide? A. Potassium ferroeyanide (yellow prussiate), deprived of its water of crystallization by heat, is mixed with half its weight of sulphur and the whole heated to tranquil fusion for some time in an iron pot. When cooled the mass is boiled with water, decanted from the residue, mixed with enough potassium carbonate to precipitate all of the iron, filtered, and concentrated over a fire to a small volume, from which crystals of potassium sulphocyanide separate on cooling.

What are the proportions used in making "oil of apples" from fusel oil? I tried it by guess, but the product smelled like walnut hulls? A. Make a cold mixture of 1 part each of amylic alcohol (fuseloil) and 1½ part of dry valerianate of soda; heat the mixture gently for some time on the water bath, and then mix it with a quantity of water, when the oil-like amyl valerianate will separate. This dissolved spirits of wine constitutes commercial apple oil.

Is methylated alcohol manufactured in this country for chemical uses? Is it cheaper than ordinary alcohol? A. Yes. It is somewhat less expensive.

(13) E. A. B. asks: Will a water wheel 3 feet under the water, in a wooden flume, make a good ground connection for a short telegraph and telephone line, say 1,000 feet? A. Yes.

(14) J. B. asks: 1. Is electric light used on metallic or ground circuit? A. Metallic. 2. How many lights can be made on one circuit, or will it take a separate conductor for each light? A. A separate conductor is required for each.

(15) C. J. M. asks: 1. How much insulated wire, No. 30, does it take for a telephone (for each magnet), the magnet being a permanent one, 5 inches long and ⅜ inch in diameter? A. No. 30 wire is not fine enough. Use 1 oz. of No. 38 or No. 40 for each magnet. 2. And for what distance would such a one answer? A. 100 miles. 3. Also, will rust on an iron wire interfere with its use? A. No. 4. I was once told that the wires should not be any closer than 2 inches from the house or any other object. How is this? A. The line wire should be supported on insulators.

(16) R. C. C. asks: 1. How far from an electro-magnet can I attract or draw the metal to be attracted? A. If at ⅛ inch distant the armature is attracted with a force measured by 100 grains, at 1 inch it would equal but 1 grain, etc. 2. Does it require the metal to be attracted to be in weight equal to the strength or force of the magnet? A. No. 3. For strength or attraction which is preferable, a horseshoe or a magnet made from gas pipe, as illustrated in your previous issue? A. The horseshoe form is one of the best.

(17) G. E. S. writes: I made a phonograph, to the best of my belief according to your description in the SCIENTIFIC of March 30, 1878. It will not reproduce my voice. Following is the description of the one I made: A brass cylinder 8 inches long, 12 in circumference and about 1/16 in thickness, with threads cut on 16 to the inch and 1/32 in depth. Cylinder working on an iron rod which runs through cylinder, and held in position at each end of cylinder by open brass work. Rod works through brass bearings, threaded to correspond with cylinder. The machine is screwed to a pine board. The mouthpiece is a small wooden round box, lid off, and hole 1 inch in diameter cut out of bottom. Small rubber tubing laid in box, on that a regular telephonic diaphragm with more tubing on top, the whole being fastened down by brads. The spring is thin brass fastened to mouthpiece holder, and reaches to center of diaphragm. A common steel sewing needle, large size, point rounded off a little, ½ or ¾ inch long, is driven half through brass spring. Upper end of needle has small piece of rubber on, which rests lightly against diaphragm, other end running in groove on cylinder. Makes a slight mark on tinfoil when I turn crank, and slight indentations when I talk on the diaphragm. The reproduction is a grating sound. What is the fault and how can I remedy it? A. SCIENTIFIC AMERICAN SUPPLEMENT No. 133 will contain full information for the construction of a phonograph.

(18) A. asks: 1. How can I decompose water by electricity? A small volume of water only. Is it necessary that the current pass directly through the water? A. Place water in a suitable vessel and add to it a small quantity of sulphuric acid to increase its electrical conductivity. Fill two test tubes with the acidulated water and support them with their months below the surface of the water in the vessel. In the mouth of each tube insert a plate of platinum, and connect the plate with the poles of a battery of 4 or 6 Bunsen cells. Oxygen is liberated at the positive pole, and hydrogen at the negative pole. 2. Would magnetism or electricity generated by friction answer the same purpose? A. Static electricity decomposes water feebly. 3. Is there any other practicable way of decomposing water? A. By subjecting steam to an intense heat.

(19) C. W. D. writes: 1. There are parties making chilled plows who claim they chill or harden their iron by putting something in the ladle of melted iron before pouring it into the moulds. Can you tell me of anything that will do the same? A. We do not know of anything. If any of our readers can furnish information on the subject, we would be glad to hear from them. 2. What is the result of putting scrap iron or steel in the cupola when melting, or in the ladle of melted iron? Does it melt and unite with the cast iron? If so, does it do any good, or does it burn up and amount to nothing? A. It generally improves the product. 3. Will malleable iron melt in with cast iron in a cupola? A. Yes.

Can you tell me where I can buy a mechanical pigeon like the one described in your "Science Record" of 1873, p. 548? A. You can obtain it from a dealer in sportsman's goods.

(20) R. D. asks: Can you inform me of any material which, if put in a cup or other vessel, would disengage sulphurous or other poisonous fumes sufficient to saturate a confined space of 1 cubic yard at a cost of 5 to 10 cents without the use of fire? A. Throw a few scraps of zinc and a drachm of arsenious acid into a wide-mouthed bottle containing dilute sulphuric or hydrochloric acid. The gas given off—arsenious hydride—is extremely poisonous even when diluted with much air. Hydrogen sulphide may be economically procured by the action of dilute oil of vitriol on pulverized ferrous sulphide (FeS); this is prepared by exposing red hot iron filings to fused sulphur, or by fusing together in a crucible 5½ parts of iron and 12 parts of common crystallized iron pyrites (FeS_2).

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

May 7, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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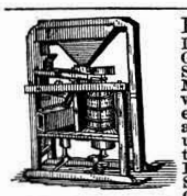

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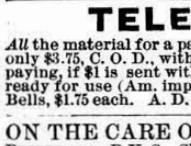

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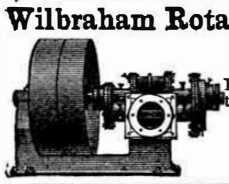

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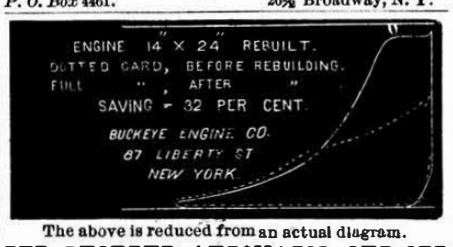

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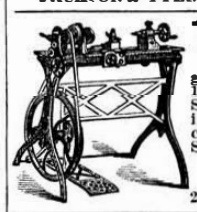

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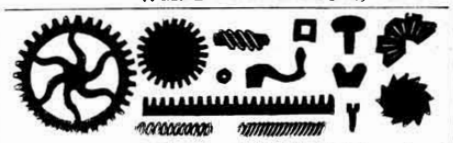

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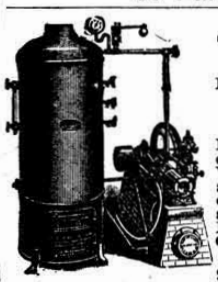

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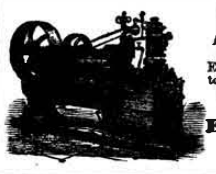

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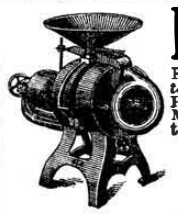

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